



# **ICT and Economic Analysis: Discipline Disruption or Old Wine In New Bottles?**

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# ICT Economics

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## What is it?

- ICT services are broken down into: **Storage**, **Compute**, and **Bandwidth**.
- Information and Communication are inextricably tied together.
- How information is communicated is as important as what information is communicated.
- ICT touches almost everything we do and has radically changed markets, economies, policy choices, and culture.



# ICT Economics

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## What do we know?

- In Economics, we know a lot, but it is scattered across many subfields.
- In Business, we know it is critical, but it is hard to understand, choose, and integrate complex and rapidly changing technologies.
- In Policy and Regulation, the technology moves faster than Governmental bodies can.
- New technologies arise, gain market traction, attract the attention of regulators and policy makers, and then companies, lobbyists, consumers, experts and advocates weigh in.
- Even if good policy is made, it is often about a dead or dying technology



# The Roots of Change

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## **Storage: Generating and storing data at a granular level is cheap**

- Records: Medical, financial, legal, education, employment
- Identity: Biometric, public, government
- Telemetry: IoT devices (Internet of Things), smart city, satellite, cameras
- Big Data: Click streams, customers, users, social media, genomics



# The Roots of Change

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**Communications: Collecting and distributing data and content at a granular level is cheap.**

- Wired: Fiber Backbone, POTS, and cable
- Unlicensed spectrum: WiFi , Blue tooth, Zigbee RFID, NFR
- Licensed spectrum: PCS (cellular), satellite, white space, narrow band



# The Roots of Change

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**Compute: Processing mass quantities of data is a useful way is cheap.**

- Cloud Computing: Hardware on demand
- Mesh Computing: Harnessing unused compute cycles through Machine to Machine (M2M) markets.
- Artificial Intelligence, Machine Learning, Big Data: Data analytics on steroids



# Impact

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**On the one hand, these changes are mainly quantitative:**

- Cheaper
- Better
- Faster
- Larger
- Finer

Buy it, use it, break it, fix it,  
Trash it, change it, mail, upgrade it,  
Charge it, point it, zoom it, press it,  
Snap it, work it, quick, erase it,  
Write it, cut it, paste it, save it,  
Load it, check it, quick, rewrite it,  
Plug it, play it, burn it, rip it,  
Drag and drop it, zip, unzip it,  
Lock it, fill it, call it, find it,  
View it, code it, jam, unlock it,  
Surf it, scroll it, pause it, click it,  
Cross it, crack it, switch, update it,  
Name it, rate it, tune it, print it,  
Scan it, send it, fax, rename it,  
touch it, bring it, pay it, watch it.  
  
Work it harder, make it better  
Do it faster, makes us stronger



# Impact

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**On the other hand, quantity has its own quality and leads to material changes:**

- Disintermediation
- Disruption
- Concentration
- Leverage
- Information and Communication that push human and social boundaries





# Is Economics Still Relevant?

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## **What has not changed is human nature:**

- Consumers and Producers are still motivated by incentives, maximize objectives, face constraints, and struggle with incomplete information.
- What we learned in microeconomics is still true and is useful for understanding this brave new world.
- What we learned in macroeconomics may or may not be true (either then or now).



# Summary

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- Our tools are fine.
- Our basic material (humans) is the same.
- What has changed is the environment.



# Start Your Engines

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**Let me begin with a very quick list of how various areas of economics connect with this new environment:**

- There is no such field as ICT Economics
- The “new” ICT economy has the most of the same issues as the old one.
- Almost every sub-field has something to add to our understanding
- Many of these topics could be an hour talk in themselves.



# Old Wine in New Bottles

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## Industrial Organization:

- Economies of scale and scope
- Monopoly
- Network externalities
- Mergers and acquisitions
  - Why are Facebook and very few others the dominant social media platforms?
  - Why is Windows used by 75% of desktops and laptops, and android on 85% of smartphones?
  - Why has Amazon spread into so many product lines?
  - Why the concentration in banking and finance?
- Monopolistic competition
  - Oligopoly
  - Cloud services war between Microsoft, Google, and Amazon.
  - Why do Uber and Lyft, UPS and FedEx, coexist?
- Lock-in
  - Oracle data systems
  - Operating systems
  - SaaS (Software as a Service)
  - Social media
- Standards
  - Helps competition, but gives holdup and capture
  - DVD/Blue ray
  - 802.11x
  - CDMA/GSM
  - TCP/IP



# Old Wine in New Bottles

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## Industrial Organization:

- Loss leaders and predatory pricing
  - Free trails, freemiums, premiums
  - Discounted software and hardware to schools (MS, Apple, Google).
  - Losing money on each sale but making it up on volume (Amazon, Uber)
  - Browser wars
- Price Discrimination
  - Markets can be segmented by region or nation
  - Profiling allows first degree price discrimination
  - Amazon employs hundreds of economists
  - Big data optimizes both prices and suggestions
- Bundling
  - Subscriptions: YouTube, Netflix, Spotify, content
  - Amazon prime
  - Unlimited bandwidth
  - Connectivity and content bundling: AT&T, Comcast
  - Cloud services: AWS, Azure
- Versioning
  - Hardware: iPhones, laptops
  - Products: Tesla
  - Software: Microsoft windows, Adobe, SaaS



# Old Wine in New Bottles

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## Information Economics:

- Incomplete Information
- Imperfect information
  - Bubbles in Bitcoin and cryptocurrencies
  - Review sites
  - Augur
  - Experiential goods
  - Cognitive limitations, too many choices
  - A good lie can be halfway around the world before the truth gets its boots on.
- Search
  - Web
  - Expedia
  - Hotel.com
  - Amazon
- Reputation
- Signaling
  - Social media
  - GitHub
  - Open source software
  - Virtue signaling
  - Green washing
- Matching
  - Match.com, eBay, LinkedIn. two-sided markets
- Identity
  - Biometrics
  - Password
  - Authentication



# Old Wine in New Bottles

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## Information Economics:

- IoT
  - Things can't be unseen
  - What do your devices report and to whom?
- Disruption
- Disintermediation
  - Comes from information asymmetry or monopoly
- Secrecy
- Privacy
- Machine Learning and Big Data
  - Racist and sexist?
  - Secrecy
  - Privacy
  - Digital fingerprints



# Old Wine in New Bottles

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## Public Economics:

- Free riding
  - News and other content
  - GPL (General Public License)
- Non-rival goods
- **First copy costs**
  - Strongly pushes toward monopoly for content, software and platforms
  - SaaS
- Externalities
- Local Public Goods
  - Many differentiated sites and news sources
- Voluntary Contributions
  - Linux
  - Apache
  - GofundMe
- **Spectrum and bandwidth**
  - More of a commons than a public good.
  - Can be turned into LPG





# Old Wine in New Bottles

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## Law and Economics/Regulation:

- **Intellectual Property**
  - Extent and length of patents and copyrights
  - Copyright vs copyleft
  - Patent trolls
- **Regulation (too fast)**
  - Capture
  - Can't know the right thing
  - Too late anyway
- **Jurisdiction/Nexis**
  - Where should Google pay taxes (often a normative question or a zero-sum game)
  - Who should regulate content and standards?
- **SEC**
  - Cryptotokens
- **FCC**
  - Bandwidth and content
  - Net neutrality
  - Common Carriers



# Old Wine in New Bottles

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## Behavioral and Experimental Economics:

- **Randomized Control Trials (RCTs) and A/B Testing**
  - Amazon, Facebook, LinkedIn
- **Loss Aversion**
  - FoMO (Fear of Missing Out)
  - Limited time offers
  - Now or never decisions
- **Sunk Cost Error**
  - Loyalty programs
- **Confirmation bias**
- **Addiction**
  - Games, YouTube
- **Peer Pressure, herding, status, position**
  - Twitter, Reddit, Facebook
  - Badges
- **Expressive voting**
  - Reviews
  - GoFundMe
  - Biased news sources and forums



# Old Wine in New Bottles

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## Labor Economics:

- Gig Economy
  - Efficient? Exploitative?
  - Monopolized, so platforms set the terms
  - Race to the bottom for providers?
- Automation and autonomous Vehicles
  - Loss of low skill jobs
  - More efficient use of streets
- No compete agreements
- Work from home



# Old Wine in New Bottles

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## Macroeconomics and Banking:

- Information and expectations formation
- Shadow banking
- Cryptocurrencies
  - QTM
  - Bubbles
  - Finance
- KYC/AML
  - Anonymity vs surveillance
- Micropayments and transactions costs
  - Upsets the advertising for web services model
  - M2M markets
  - P2P markets
  - Upsets banks and credit cards



# Old Wine in New Bottles

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## Trade and Development:

- Technology diffusion
- Service outsourcing
- Data centers?
- Innovation
  - Economies of scope in innovation
  - Incentives to innovate
  - Permission to fail



# Old Wine in New Bottles

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## Environmental:

- Blockchain and Proof of Work
- IoT sensors, automaton, control and optimization
- [Better use of resources](#)
- Materials
- Race to bottom in environmental standards
- Cost-Benefit
  - Recycling
  - Ethanol
  - Renewable energy
  - Electricity storage costs



# ICT Makes Things Hard

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**Almost everything in ICT is a problem we have seen before, but:**

- Problem are more convoluted and complicated
- Difficult to grasp
- Global
- Fast
- Many unintended consequences



# Economics Makes Things Easy

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## What to do:

- Theory: Start with the right economic theory
- Facts: Determine and understand the facts
  - Budget and financial constraints
  - Material and technological constraints
  - The nature of the market
  - Global and general equilibrium considerations





# Economics Makes Things Easy

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## What to do:

- Objectives: Figure out the normative objective.

or

- Question: Figure out the the positive question.
- Do the math!
- Have a beer!!



# Wrapping Up

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## **The most Important ICT issues (IMHO):**

- IoT
- Intellectual property
- Privacy and censorship
- Serial monopoly, market concentration, and regulation
- Spectrum use and allocation
- Blockchain



# Thanks!

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Links of potential interest:

[The Economics of Cloud Computing](#)

[ICT Economics Book – Spring 2018](#)

Personal page with technical and nontechnical writings on ICT and Economics:

<http://www.jpconley.com/>