

Economics 124
SPECIAL TOPICS IN INDUSTRIAL ORGANIZATION

General. This seminar course will cover the economics of the so-called ICT (information and communication technology) industries. While we will look to current developments in this sector for our discussions, they will be guided by concepts from the field of Industrial Organization that are universal.

The I.O. concepts will be reviewed and developed throughout our excursion of the ICT industries. They include component systems, economies of scope, product bundling and tying, network externalities and congestion, information cascades, user switching costs, first and second mover advantages, disruptive technologies, Schumpeterian competition, technological races, technology spillovers, learning by doing and new product and process diffusion.

The concepts will shed light on developments in the personal computer, fixed and mobile telephone, Internet services and eCommerce, entertainment video (broadcast, cable, IPTV) and video game industries, among others. The source for these developments will be popular and trade press. Students are required to read one or more high quality newspaper or magazine that covers these areas. Students will be asked to report weekly on significant events from the news. The course does not have an assigned textbook but there are a couple of general purpose books that will be recommended.

Enrollment. Admission to the course will follow the standard TeleBears process. Because this seminar will take all standard I.O. concepts are given, completion of Economics 121 or 126 is a prerequisite for enrollment; completion of Economics 123 is an acceptable alternative, as is an introductory course in game theory such as Economics 110 or Business Administration 143. Completion of prerequisites will be enforced. In cases where satisfaction of requirements is in doubt, please petition the instructor for a course entry code.

Meetings. The seminar will meet for discussion every Tuesday and Thursday, 12:30-2:00 PM in 3 Evans Hall—though beginning February 1st we will move to the seminar style room in 279 Dwinelle Hall. You can reach me in several ways, with email being the best:

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Phone:	642-4308
Email:	glenn@econ.berkeley.edu
Office hours:	Tuesdays, 2:30-3:30 PM & Thursdays 2:15-4:15 PM

It is hoped that outside speakers will be able to join us on some of the meetings to share their real world experiences.

Assignments and Grading. There are four assignments in this course: (1) serve at two class meetings as news reporter to the class covering recent news events of the ICT industries (in the U.S. or abroad) and explain those events in terms of I.O. economics, (2) present to the class one paper that is on the course reading list, (3) write a research term paper in the area of the topics covered in the course—analyzing some industry or development, evaluating a policy debate confronting the ICT sector, and (4) present your findings to the class. Grading will be a weighted average of the assignments. About half of weight is given to the term paper with the remainder split among the other three assignments.

Web Site and Email. The course has a web site located at: <http://elsa.berkeley.edu/~woroch/ec124/> The goal is to post all reading material to this site in electronic form without violating digital copyrights.

Readings. There is no required textbook for this course. However there are several books that provide good treatments of specific portions of the ICT industries. Among those which broadly cover most of the topics we will examine are:

Information Rules: A Strategic Guide to the Network Economy, by Carl Shapiro and Hal R. Varian, Harvard Business School Press, 1998.

The Economics of Network Industries, by Oz Shy, Cambridge University Press, 2001.

Beyond these two books, we will review many working papers and published articles that provide the background and development of each topic. These will appear on a separate reading list that will follow, but will stay close to the collection of topics given below.

Topic Coverage. The course will consist of four main parts. The first two contain many of the “tools” that will help analyze the ICT industries. The last two are policy focused and likely will be the source of term paper topics.

I. ECONOMICS OF COMPONENT SYSTEMS AND NETWORKS

1. Component Systems

- a) Components, compatibility and complementarities
 - i) Architectures of components: stacks, layers, interfaces, essential vs. peripheral
 - ii) Examples: computer systems, audio/video systems, video game systems, telephone networks, client-server networks, analog and digital photography, credit and debit card systems
 - iii) Economics of complements and modularity
 - (1) Akin to interchangeable parts
 - (2) Enables selective competition and innovation
 - (3) Complementarity depends on the quality of the interoperability, which is a strategic choice
 - (4) Changes the usual IO emphasis on horizontal competition to vertical “co-opetition”
- b) Convergence and the economics of system effects
 - i) Scope economies vs. specialization and (component) innovation
 - (1) Example: digitalization of content and broadband access
 - ii) User mix-and-match vs. supplier integration
 - (1) Example: compare Apple Mac and IBM PC approaches
 - iii) Tradeoff between scale economies and customization
- c) Pricing, bundling and marketing component systems
 - i) Model of Cournot’s “complementary monopolists”
 - (1) Strategies for mitigating double marginalization
 - ii) Pricing complementarities and the possibility of loss leaders
 - iii) Product bundling to reduce transaction costs, to price discrimination
 - iv) Consumer demand for bundles
 - (1) One-stop shopping (triple play, grand slam) vs. best of breed
 - (2) Role of selection and matching
- d) The case of digital convergence
 - i) Various meanings of convergence: device, content, providers, transport
 - ii) Case studies in technological convergence:
 - (1) Fixed-mobile convergence or fixed extinction by mobile
 - (2) Cellular and WiFi networks: mobile/nomadic voice+data
 - (3) Data and voice using a PC: bypassing the PSTN by using the PSTN
 - iii) The competitive and efficiency implications of digital convergence
- e) Product bundling and tying to exclude competitors
 - i) Technical tying: manipulating interfaces to favor (disfavor) certain components
 - ii) Examples: the IBM antitrust case and the Microsoft antitrust trial

2. Networks

- a) Definition of networks: nodes and arcs, hubs and spokes
 - i) Relation to component systems (complementarities)
 - ii) Notion of demand-side scale economies and “Metcalfe’s Law”
- b) Taxonomy of networks: one way/two way traffic, one sided/two sided
 - i) Physical (telephone, road system) vs. virtual (computer hardware and software)
 - ii) One way (broadcast TV and radio, electricity) vs. two way (most communications networks)
 - iii) One sided (voice communications, peer to peer) vs. two sided (ATMs, eBay, Google)
- c) Examples: electricity, transportation, telephone, Internet,
- d) Network effects/externalities
 - i) Sources of positive (or negative) feedback effects
 - ii) Simple model of equilibrium with network effects
 - (1) The chicken-and-egg problem and critical mass
 - iii) Examples: fax machines, email, IM
- e) Implications of network effects
 - i) Excess inertia and excess momentum
 - ii) Tipping and selection of inferior technologies
 - iii) Case studies:
 - (1) Standards wars: AC/DC electric power, Betamax vs. VHS, Blu-Ray vs. HD DVD
 - (2) Locking QWERTY, Windows
 - (3) Installed base effects: Adobe Acrobat/Reader
 - iv) Death spiral: quadrasonic sound, laser disks
- f) Strategies of network competition
 - i) Attract lead users
 - ii) Subsidize complements to enhance the core network good
 - iii) Interconnect disjoint networks
 - iv) Back ward compatible to enable users to re-use prior investments (e.g., Nintendo Wii)
 - v) Introductory pricing to entice early adopters
 - vi) Pricing exchange of traffic (e.g., bill and keep, internet peering)
 - vii) Standardize interfaces to improve compatibility
 - viii) Provide converters or translators
- g) Negative network effects
 - i) Incremental user/link reduces the value of existing users
 - ii) Examples: congestion on the highway, cable modem services, viruses on IE
 - iii) Strategic response: “gate communities” “firewalls”

II. INNOVATION, DIFFUSION, AND DISRUPTIVE TECHNOLOGIES

3. Diffusion: Innovation v. Imitation

- a) Historical diffusion of consumer and producer innovations
 - i) Consumer product diffusion
 - (1) S-curves of consumer electronics (TV, radio, fax), general purpose technologies (auto, electricity)
 - ii) Process innovation diffusion
 - (1) The classic midwest hybrid corn diffusion
 - (2) Other examples: basic oxygen furnace

- b) Theoretical models of product and process diffusion
 - i) Epidemic models: exponential, logistic/Mansfield model, Bass hybrid, Gompertz, Richards
 - ii) Probit models: importance of consumer heterogeneity
 - (1) Bell shaped distribution of types by propensity to adopt: lead users, followers, et al.
 - (2) The “long tail” and the potential for digital differentiation
 - iii) Sociological models: Carroll, Freeman, et al. on competition and legitimization
 - iv) Information cascades:
- c) Extreme economics of digital goods
 - i) First copy costs vs. negligible marginal costs
 - ii) Localism vs. globalism in broadcast media
- d) Role of installed base on diffusion
 - i) Intergenerational compatibility
 - ii) Persistence of monopoly from one generation to next
- e) Strategies to promote diffusion
 - i) Attract lead users
 - ii) Subsidize complementary products and services
 - iii) Introductory pricing
 - iv) Stimulate network effects as above: intro pricing, lead users, complements, etc.
- f) Failure of diffusion: the death spiral
 - i) Examples: Betamax, 8 track and DAT tapes, Apple’s Newton

4. Schumpeterian Competition and Disruptive Technologies

- a) Schumpeterian competition
 - i) Winner take all (or most) competition at the heart of the “gale of creative destruction”
 - ii) Bertrand model of dynamic differentiated product competition
- b) Example: Battle of game platforms
 - i) History of leapfrogging by byte size and polygons
 - (1) Atari, Sega, Nintendo, Sony
 - (2) New landscape of Microsoft Xbox, Sony PS3, Nintendo Wii
- c) Role of intellectual property
 - i) Importance of interfaces
 - ii) Role of reverse engineering
- d) D.T.’s defined
 - i) Examples
 - (1) Computer memory: succession of computer hard drives with steadily increasing data densities
 - (2) Music distribution: Peer to peer file sharing
 - (3) Voice communication: Voice over Internet Protocol (VoIP)
 - (4) Photography: digital displacing film
 - ii) The special case of peer-to-peer file sharing
 - (1) Compare traditional and P2P music provision: different technologies, different business models
 - (2) Response of the incumbent music industry and DRM
 - (3) Impact on CD sales and the emergence of music downloading
 - (4) Lessons for IP TV

5. The Role of User and Supplier Switching Costs

- a) User switching costs
 - i) Defined and distinguished
 - ii) Relation to network effects
- b) Customer “lock in”

- i) Vendor strategies for creating switching costs (contracts, proprietary devices)
- ii) User strategies for reducing switching costs
- iii) The case of number portability
- c) Negative feedback and congestion effects
 - i) Congestion on links and nodes (e.g., “the last mile”)
 - ii) Demand for privacy and security

6. The Economics of Standards

- a) Taxonomy
 - i) De facto (Windows, PDF) vs. de jure (weights and measures, HDTV)
 - ii) Sponsored (Microsoft, Adobe) vs. unsponsored (industry standards)
- b) Standard setting organizations
 - i) Examples: IEEE, IETF, ETSI, ASAE
 - ii) Open vs. closed membership
- c) Strategies surrounding standard setting
 - i) Pro-competitive: realizes transaction costs savings for consumers, realizes scale economies in production, promotes interconnection, promotes innovation in product components
 - ii) Anticompetitive: exclusionary in that favor certain established suppliers, may contact patented technology
- d) Standards wars
 - i) Noncooperative v. cooperative models of standard setting
 - ii) Often result in incompatibility technologies
 - iii) Examples
 - (1) Betamax v. VHS and now Blu-Ray vs. HD DVD
- e) Closed vs. open standards
 - i) What is open source and how has it fared?
 - ii) Case studies of proprietary and open software competition: Apache vs. Unix, Windows vs. Linux

III. CURRENT POLICY ISSUES IN THE ICT SECTOR

7. Antitrust Cases and Developments

- a) Exclusionary behavior in component system product markets
 - i) Exclusion of competitor via technical tying/incompatibility: IBM peripheral cases
 - ii) Exclusion via bundling: Microsoft marketing of IE
 - iii) Price squeeze on unintegrated rivals: the case of the local exchange
 - iv) Predatory product innovation: Kodak
- b) Antitrust of interfaces and interoperability of networks and component systems
 - i) U.S. focus on nondiscriminatory access:
 - (1) Cable open access debate
 - ii) Europe’s pro-active policy of forced opening/compulsory licensing
 - (1) Microsoft’s Vista in Europe
 - (2) French decision to force open iPod/iMusic system
- c) Standard setting organizations
 - i) Membership issues, ex ante IP issues
 - ii) Recent cases: Unocal, Rambus

8. Issues in the Regulation of Network Industries

- a) Debate over “Network neutrality”
 - i) Background on network architecture
 - (1) Layered view of the Internet and end-to-end concept
 - ii) Policy implications
 - (1) Clark, Lemley, Lessig on preserving end to end structure and its innovativeness
 - (2) MCI’s Layered Regulation proposal
- b) Unbundling and sharing of NGN (next generation network) facilities
 - i) Curious case of the Telecom Act of 1996 and Sect. 703
 - ii) Effects on entry and incumbent innovation
 - iii)
- c) Broadband penetration and the digital divide
 - i) International comparisons, and the rural policy issue
 - ii) Alternative strategies for closing the divide
- d) The switch over to DTV
 - i) Federal policy and industry compliance
 - ii) Empirical evidence on broadcaster and user adoption
 - iii) The part played by the consumer electronics industry
- e) Municipal wireless broadband networks
 - i) The technology and cost: WiFi and WiMax
 - ii) Comparative institutional analysis of private v. public provision
 - iii) Policy alternatives such as build and lease back, auctions
- f) Release of additional radio spectrum
 - i) Licensed or unlicensed? Banded or ultra wide band?
 - ii) Auctions or beauty contests?
 - iii) How to compensate current tenants in spectrum bands?

IV. ICT AND ECONOMIC DEVELOPMENT

- 9. Assessing the effectiveness of ICT in the developed world
 - a) Evidence (and lack thereof) relating ICT to growth and productivity
 - i) notion of general purpose technologies
 - ii) empirical evidence of the missing effect
 - iii)
 - b) Policy toward the “Digital Divide”
 - i) Recent documentation of the nature and extent of the digital divide, and its many facets
 - ii) E-rate and other programs and their effectiveness
 - iii) International comparison of pro-broadband policies from Europe and Asia
- 10. The least-developed world: the bottom of the pyramid
 - a) Challenges of ICT deployment: electricity, skills, language, computing, networks
 - i) Proposals: Negroponte’s \$100 computer vs. a system of shared use of computers
 - b) Amazing story of mobile phones
 - i) Examples of mobiles used for info exchanges, minutes a new kind of currency
 - c) Country studies taken from India, sub-Saharan Africa
 - d) Case studies of education, health