

ECONOMICS OF INFORMATION: A BRIEF INTRODUCTION

by Will Wheeler

Editors' note: This essay was originally prepared for an encyclopedia in the LIS field several years ago, but was for some reason not included in volume. The essay more clearly than any other source we have read, briefly delineates the intersections between economics and LIS, its history, and those particular areas of LIS that economics shapes-by-measuring or simply elides. Wheeler was invited to read Braman's more recent contribution to the field and reflect on the intervening years and his experiences during that time. Thus the piece PL publishes here includes an epilogue and a few very recent sources to reflect on the continuing gaps in our understanding – and economists' understanding of us. For a complete and more recent set of background sources we would direct readers to the bibliography here along with those in Braman's two works noted therein.

Researchers in the economics of information come from a variety of disciplines. While most economics of information research appears in economics and in library and information science, Machlup and Mansfield in *The Economics of Information: Interdisciplinary Messages* note contributions from other fields including psychology, sociology, linguistics, communication, engineering, computer science, cognitive science, artificial intelligence, and cybernetics. Issues raised touch on additional fields including especially philosophy, political science, government, and policy studies. Within economics, the economics of information can be seen as a critique of classical models with implications for almost every kind of economic inquiry, especially decision making, forecasting, uncertainty, equilibrium theory, rational choice, and game theory.

Economics of information per se first emerges as a field of inquiry in the 1960s in response to a growing awareness of fundamental changes in world economies driven by the emergence of computer technology increasingly allied with telecommunications. Mid-century concerns with the changing roles of computers, mass media, publishing, R&D, patents, education, and libraries dovetailed with previous work on the role of knowledge in economic models. Researchers at this time also began to recognize growth in information industries, growth in the commodification of information, and growth in the information sector as percentage share of the general economy. Central issues arose about the nature of information itself and its economics.

Economics of information is distinguished from other economic inquiry by concerns with and the inclusion of information processes in economic models, the difficulty of measuring information and its subjective aspects,

and the unique characteristics of information as a commodity. Economics of information researchers have spent the majority of their time identifying the parameters of these concerns, refining the ways we understand what information is, and modeling how it affects economic transactions. One fundamental distinction is between information as an aspect of any exchange and information as a thing exchanged. Other distinctions emerge.

The two main sets of researchers, economists and library and information scientists, approach the economics of information from different perspectives. Library and information scientists, informed by economic theory but immersed in information as their primary “commodity,” have tended to look at notions of what information is and at information products as items bought, sold, used, copyrighted, made public, or provided, particularly in libraries. Economists have tended to study the nature of decision making, the distribution of information, imperfect knowledge, the flow of information, and the role of the “information sector” in a market context. Both sets of researchers attempt to refine models to account for price, costs, benefits, values, and economic impacts.

Basic terms for economic transactions remain the same for information as for any other commodity, but researchers agree information has special characteristics that make it more difficult to work with. Definitions of price, cost, benefit, value that can be found in any introductory economics text apply here as well. Price is simply the amount charged in dollars, but how a market price is arrived at in terms of competition and distribution is more complex. Costs are also complex including costs of production, costs in time, cost in wages, and costs in terms of alternatives that might have been purchased or time that might have been spent in other ways than the consumption of an item. Benefits are complex as well including benefits to the consumer, benefits to the producer and the seller, and benefits to society as a whole. The concept of value is the most difficult; some economists believe it can only be known subjectively, others have attempted complicated models of utility to account for value. In any case, value to whom and in what circumstances is a few of the complicating variables.

The Nature of Information: Library & Information Science Views

Sandra Braman in “Alternative Conceptualizations of the Information Economy” provides a detailed exposition of the nature of information that falls into a number of larger categories including: creation, time, space, intangibility, heterogeneity, and public good. In these categories we see “information” as different as other commodities: information is created for reasons beyond the market (self expression, for example) and production can be widely distributed to the point where space difference between producer and consumer disappear. Information is intangible with no set unit of measure and very heterogeneous having no set kind (conversely a single kind of information can have more than one form). Time is the most complex aspect of information: information is highly perishable

(stock reports, for instance) and can be nearly simultaneously consumed and produced (for example, live news), however, it is not predictable how information may be used by different users, which brings into question not only its perishability but also its value. (p. 101-102) Braman points out that information is difficult to define, that it is "valued differently by different people" (p. 105) and that "the same information product can serve multiple functions. (p.106)

Taylor in "Value-Added Processes in the Information Life Cycle," provides a useful schema for the information life cycle as it moves from "data" to "information" to "informing knowledge" to "productive knowledge" to "action." (p.342) Taylor goes on to describe elements of the processes by which data gets moved to action including "organizational processes" such as "grouping, classifying, relating, formatting, signaling, and displaying"; "synthesizing" processes including "selecting, analyzing, validating, comparing, and interpreting"; "judgmental" processes, including "presenting options, advantages, disadvantages" where the user makes choices about the most advantageous information to use; and "decision" processes where the user is "Matching goals, compromising, bargaining, and choosing." (p.342) Taylor goes on to note that "Value is not inherent in nor is it carried by a message," that "a message has value only in context", that "A message is given value by a use ... in particular environment," that "messages therefore carry (only) a potential for value," and that "(therefore) value added processes are ... those that ... signal this potential, and /or can relate the potential to the needs of a specific environment."(p. 343).

Jose-Marie Griffiths in "The Value of Information and Related Systems, Products, and Services" reviews a wide range of articles and theory related to the economics of information. Griffith's notes as others have that it has no unit of measure, that pricing, value, costs, and benefits are complex. She also argues that "When obtaining information, it cannot be assumed that the whole price is a measure of the value of that information to the purchaser" that "Benefits and costs may not be fully obtained and borne out by the consumer and producer," and that "The individual who decides whether or not to use an information service is not necessarily the one who is affected by that decision." (p. 280).

Other Library & Information Literature

A number of very useful reviews of literature on economics of information appear in the *Annual Review of Information Science and Technology (ARIST)*. At least five annual issues have articles that deal explicitly with the development of the field between 1973 and 1987. Two more current issues of *ARIST* have moved on to simply review information product pricing. These articles show that, in general, library and information science research on the economics of information has concentrated on understanding the economics of information products and services. Repo, for example, notes issues of evaluating products and services (cost-benefit analyses) to determine how libraries should allocate expenses and

determine usefulness for library users, the complex costs of information products (like databases) for libraries, price comparisons for producers, effectiveness of products for users, budget impacts on libraries, and value to researchers in saved time or enhanced decision making. Lamberton's 1984 *ARIST* review, however, is devoted to the pioneering economics work of Marchak and Machlup. Spence 1973 provides another historical survey of economics of information literature. Hindle & Raper, Griffiths, and Cooper provide reviews of library literature on the economics of information while also touching on their underpinnings in economics research. Another important compilation of work in the economics of information is King, Roderer, and Olsen's *Key Papers in the Economics of Information*. Here are represented and reprinted a wide range of articles on economic issues of costs, value, and pricing, but also specific articles that speak to library issues such as school media program budgeting, user fees, computer service marketing, national policy, and the benefits of scientific information.

The Economists View: Information in Decision Making

George Stigler in "The Economics of Information" investigates the nature of information in a market. Using the example of car sales, he notes that the savvy buyer will know that prices are not distributed evenly and therefore will invest in "search." Stigler provides a number of scenarios and equations for how the cost of searching for the best price interacts with the prices likely to be found in a market. Complications to this are the kinds of search producers engage in to know what prices they can charge and their costs in searching for buyers (advertising). An important article that extends Stigler's model of the market into issues of "value" is Akerlof's "The Market for 'Lemons': Quality Uncertainty and the Market Mechanism." Akerlof also uses the car market to illustrate features of information. Used cars, for example, display interesting features because the used car owner will necessarily have more "information" about the car s/he trades and therefore one might expect only bad cars will be traded. Akerlof goes on to explore the effects of dishonesty in a market and the tendency for "information asymmetries" to drive out legitimate trade. Implications extend to insurance, health care, government policy, and consumer protection.

An influential interdisciplinary economist often cited by economics of information researchers is F.A. Hayek. In a 1936 address entitled "Economics and Knowledge" Hayek notes the essential connection between economic analyses and notions of how knowledge is acquired and communicated (p. 33). He refers to the work of F.H. Knight on "risk" and the work of Irving Fisher on "anticipations" as precursors to his discussion. He also notes problems with the term "data" in connection with equilibrium models in economics. In a later article, "The Uses of Knowledge in Society," he explores notions about the decentralization of information arguing that a centralized (policy) body can never know the on-the-spot details necessary for making correct economic decisions and therefore modeling from a

centralized mode will simply not work. Economic decision making must be seen as a widely dispersed and decentralized process. Conversely however, there are market mechanisms, especially the price system, which act as a centralizing function. An individual economic actor can act to economize (or not) without having perfect knowledge of the causes behind price increases or decreases. The market itself, through the mechanism of price, acts as a central information distributor. Interestingly Hayek explores in later work in the field of psychology, the paradox of the human ability to act and make “rational” choices on information that we do not completely understand. This kind of cross-disciplinarity continues to be reflected in such instances as the *International Encyclopedia of the Social Sciences* whose entry on “Decision Making” is divided into psychological, economic, and political science aspects and in the interdisciplinary work previously mentioned.

In a key article “The Economics of Knowledge and Knowledge of Economics.” Kenneth Boulding notes a number of difficulties with the concept of knowledge in economic models. Confining his area of study to the “ecosphere,” Boulding points out three areas of economic inquiry that have been adversely affected by ignoring knowledge in the equation. Market analysts make the mistake of assuming perfect knowledge. Development economics relies on mechanical models of technological development without noting the importance of education and training. Decision models do not account for the complex interactions of images of the future (on which people decide what to do) preferences (that are learned, not innate), and the effects of pricing on preferences.

While there is growing acceptance of the notion of an information economy, issues of imperfect knowledge in decision making continue to plague economic analysis. Brian Loasby in *Knowledge, Institutions and Evolution in Economics* (1999), following on Hayek and others, notes (still) the tendency for simplifying conjectures in economic models. There are (according to Loasby) at least six obstacles to our understanding of the world, perhaps the most important being the constancy of change. A paradox emerges: “our ability to predict the future depends on its similarity to the past, but our need to predict the future results from our belief that it will be different from the past, in ways that are excluded from the definition of rational expectations.”(p.5) Loasby points to flaws in rational choice models of economics, especially with respect to complexity, time, purposeful change, and the costs of decision making.

The Information Economy

Fritz Machlup in his seminal *Production and Distribution of Knowledge* (1962) provides the kind of detailed exposition that defines his works as a seminal text. While noting economists have tended to ignore the process of information, especially time factors, in market models, he goes on to identify features of information as process (becoming informed) and as content. Starting at the broadest level Machlup suggests five kinds of knowledge –

practical, intellectual, pastime, spiritual, and unwanted. (Miksa argues that these categories cannot be seen as attributes of information, but rather must be seen as attributes attached by the information user.) Machlup goes on to describe various information industries (including education, research and development, media and communication, information machines, and information services) and projects the relationship between knowledge production and the gross national product.

A landmark study is Marc Porat's 1977 attempt to quantify the United States information economy. Porat defined his question as "What share of our nation's wealth originates with the production, processing and distribution of information goods and services or what is the extent of the information activity (as opposed to agriculture, services, or industry), as a portion of the total U.S. economic activity?"(p.1) Porat provided the following definitions: "Information is data that have been organized and communicated. The information activity includes all the resources consumed in producing, processing and distributing information goods and services." He identifies two key components to the information sector: the primary one which exchanges information goods in a market context, and a secondary one that exchanges information goods in a non-market context, such as government agencies, internal organization information exchange, and various other kinds of bureaucracies that create and distribute information. Porat is unique in providing very fine-grained definitions and distinctions for information processes in the economy. He finds that primary and secondary information sectors account for 46% of the 1967 United States economy and that 53% of all (1967) labor activity was information related.

Summary

Long before the emergence of machine computing, telecommunications, and the Internet economists were trying to account for the role of information/ knowledge in their models. The problem continued to grow in importance in the post-industrial age and information society where the sheer amount of information and speed of transfer has changed the nature of economic transactions. Current work in this area is best seen in game theory. Information science emerges because of developments in computing; the Internet has added further complexity. Its main economic concern has been with information organization and packaging, especially for and in libraries that provide information services. Pricing, costs, and benefits associated with complex electronic databases, web development, and information technology are their current concern and this work can be seen as another extension of the economics of information.

Epilogue

A more comprehensive and elaborated review of the information economics is Sandra Brahma's recent "The Micro- and Macroeconomics of Information," (see below), but even there, in a journal one might hope

could offer some practical advice there is nothing to help the practicing librarian or other information specialist. The answer continues to be fascinatingly complicated, but practical advice remains ineluctably elusive. I argue that the primary need – for an economics of information theory that can be applied to daily practice – is not met, and what I would like to see is some reasonable attempt at a model that would combine decision-making issues with information product issues. This would be a useful beginning of a theory that librarians could apply in everyday decisions (like e-resource costs and value).

Even with all the developments of the web and the internet, even with ever wider variety of data gathering and manipulation and the seemingly ever growing amount of information that might be applied in an economics equation or a library decision, neither economists nor librarians seem to have gotten much further in reckoning or including the value of information in their thinking. Books like *The Wal-Mart Effect* and movies like *Wal-Mart: The High Cost of Low Price* raise fundamental questions about the centralizing function of “price.” Articles like the Economist’s special report on (the failure of) democracy in California, that discovers more educated voters in the complex California information landscape often vote against their self-interest (“What Do You Know” p. 14) raise fundamental questions about decision making. From these we can begin to grasp the serious limitations of theories so far proposed for information economies in practice. It seems to be too complicated for modeling anything usefully less complex than real life. The theory doesn’t yet facilitate understanding.

We seem to be stuck in a mode where we continue to unpack the complexity of information theory and information economics, but still rely on simple comparisons - letting people draw multiple un-testable conclusions. A good theory might correlate a wider array of variables across decision making and commodities to get us somewhere interesting, unexpected, and useful. And it’s not just us: all sorts of complex information gathering now possible via the internet has not resulted in better understandings of information economies, rather they have fallen into a similar trap where common sense theory can’t handle the complexity. Consider the recent *New York Times* article and graph about public opinion regarding Bin Laden’s death – it’s a simple correlation with no indications (other than geo-location) of the other factors affecting opinion. We information specialists ought to lead in this area, not follow what happens to be do-able.

If we think for a moment about Stigler’s work or Akerlof’s “market for lemons” or in the related context on information networking of Granovetter’s “strength of weak ties” – these theoretical papers, through examples, give insight to regular practitioners and provide useful instruction while sparking interest in theoretical issues. I think we need something like that for our situation regarding the economics of information – something like “the market for bad database in the scant comparative information landscape” or “the strength of e-journal access in time savings even though weakly consumed on the package level.” This is the kind of sophisticated

thinking I'd like to find to help me decide what to do and to help me think about the issues. An information science economist, by studying our case and providing a crosswalk from economic information theory to a complex information commodity practice, just might usefully inform the "real" politics and the "real" economics of information, knowledge, and society.

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