

THE CONCEPT OF INFORMATION IN CONTEMPORARY ECONOMIC ANALYSIS – AN ECONOMIC APPROACH OF INFORMATIONAL GOODS

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ABSTRACT

The concept of information as we use it in everyday in the sense knowledge communicated plays a central role in today's society. The concept became particularly predominant since end of World War II with the widespread use of computer networks. Given the central position of information in the New Economy, its approach is made from the economic theory angle. Although the information is an economic good which can be produced, consumed, buy and sell, the classical demand and supply laws do not apply in case of information. A lot of questions arise in this context: which is the cost of producing information? Which is the cost of acquiring? Which is its value? Is there a price of information like other commodities that are sold? Economic activity involves making decisions. In order to make decisions, agents need information. Thus, the problem of acquisition, transmission, and uses of information has been occupying the economists' attention for some time now. Some studies argue, in fact, that information should not be treated in economic analyses as a traditionally economic good. The purpose of this paper is to present insights from economics research the nature of information. Economic categories of cost and value are approached to evaluate the information as economic good. The cost structure of an information, and also its value is reflected to show that they are unusual compared to material goods or commodities.

KEYWORDS: *Information good; Imperfect information; Marginal cost; Network externality; Free-rider.*

JEL CLASSIFICATION: *D4; D5; D8*

1. INTRODUCTION

The question of information and its economic nature is one that has plagued social scientists for decades. As an economic category, the information takes some particular connotations. These are conditioned by its role in making decision process or in the entropy phenomenon, which usually appears in organization. Because of its quantifiable nature, information has also particular characteristics related by their cost structure and value.

The distinctive nature of information considered to be a main productivity factor in the knowledge society, requires a comprehensive approach not only as a stored and communicated collection of *bits* but as an economic good that has made the object of trade and exchange. Even if the information has been analyzed since the last century in a mathematical theory of communication, (Shannon, 1949; Craig, 2008), it has remained a problematic concept in economic theory. The goal of this paper is to examine the information in a framework with perfect and imperfect competition.

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Moreover, it will be approached the paradox of information goods' cost and value which is derived from their characteristics.

2. PERFECT INFORMATION VERSUS IMPERFECT INFORMATION

The assumption of perfect information corresponds to equilibrium models which describes the mechanisms in a pure competition market. This means that assuming that all agents are rational and have perfect information, they will choose the best products, and the market will reward those who make the best products with higher sales. Perfect information would practically mean that all consumers know all things, about all products, at all times (including knowing the probabilistic outcome of all future events), and therefore always make the best decision regarding purchase. According to the perfect information model a competitive equilibrium is a situation in which: each individual, taking prices as fixed, chooses the quantities of the different goods to produce and exchange, in order to obtain the most preferred bundle in the budget set; equality between supply and demand holds, that is, for each good, the sum of the quantities supplied is equal to the sum of the quantities demanded (Makowsky & Ostroy, 2001). All these conditions of general equilibrium theory reveal the instantly availability, and free access of information. All economic agents are perfect informed, having complete information. In reality, such equilibrium model is only theoretical. The market economy is too complicated to be fully described in simple terms. The economics of information is focused on their imperfections and on the fact that information can change the behavior of consumers, households and firms (Huffman, 2009). There are two essentially types of information - public and private information. Public, or symmetric, information is available to everyone but it might be free, or more likely costly to obtain. Private information, or asymmetric is information that is only privately known and it may be under the control of informed and interested parties who may choose to use it strategically (i.e., to increase their welfare relative to welfare of others).

The recognition that information is imperfect that obtaining information can be costly, and those asymmetries of information exist has profound implications for potential of analysis of a person or a firm. Early economics largely assumed that information is abundant or perfect and in such a situation, the human being has an unlimited rationality. In other words, there is a complete and absolute capacity for analysing. Simon (1982) is the first who introduces the concept of *bounded rationality*, which limits the amount of information a manager can comprehend about the firm's operation. He shows that in a complex situation, the economic actor is looking to study all the possibilities in order to find a reasonable solution in an uncertain situation. Usually, he will retain the first option that seems to be a satisfactory solution.

Therefore, some aspects are derived from the economic model of imperfect competition. Stiglitz (2000) states that under the standard paradigm of perfect information markets are Pareto efficient, except when there one of a limited number of market failures occurs. Under the imperfect information paradigm, markets are almost never Pareto efficient. This means that information becomes a good that has cost and value. The economic actors follow to maximize the utility of information by equaling its marginal cost with marginal utility.

3. INFORMATION AS AN ECONOMIC GOOD

Information goods are goods that can be expressed in a digital format. They are sequences of 0s and 1s which affect economic outcomes (Shapiro & Varian 1999; Quah, 2003). As a product of market, information transfers its utility in time and space through many forms of digital content. Entertainment, such as movies, music and games, and also books, software and ideas are classical examples of information goods. Considering the speed of technological progress, it is reasonable to assume that digital goods continue to gain in importance. According to Gartner (2013), consumers

spending on digital goods and entertainment products and services will reach \$2.7 trillion by 2016. This amounts to \$130 billion annual growth in spending between 2012 and 2016.

As economic good, information seems to be a problematic concept for economic theory. Some scholars consider that the distinctive nature of information as a good have led to a series of externalities which obstruct its consideration as an economic good. Nevertheless, information is something which can be transferred, has some utility, and is capable of having a value attached to it. Therefore, despite its distinctive, problematic, nature, information can be considered to be an economic good. Information goods have distinct features which have an effect on economic outcomes and economic policy. Information goods are *experience goods*, they are *non-rival* and can be *non-excludable*.

- *Non rivalry property* reveals that the consumption by one consumer does not prevent other consumers from consuming it (Shapiro & Varian, 1999). Taking into consideration the economic point of view, information can not be destroyed when used, as conventional economic goods. For example, reading a book by one person does not obstruct the others to read the same book. Unlike tangible goods where possession of a good by one deprives another of the good, information can be possessed by many without diminishing its quantity or quality (Shapiro & Varian, 1999). This property of information good has a consequence for producers and consumers related to the economic category of cost. The marginal costs of reproduction for information goods are low. While production costs are typically high and fixed for information products, these products can be copied cheaply (e.g. the master copy of a book, movie, or soundtrack).
- *Non-excludability property* means that it is hard or impossible to exclude other consumers from consuming the good: an often used example of non-excludable information good is knowledge. Since a possessor of information can transfer it to others without losing the information, the laws of supply and demand that depend on the scarcity of products do not easily apply to many information goods.

At this point we have to make the following distinction: information non rivalry property is related to the nature of information, while the non-excludability property is conditioned by the legal and technological framework. The scholars in the economics of information do not assume that all information goods are non-excludable. Jones (2002) gives some examples of non-rivalrous information goods that are non-excludable (digital music, computer games) and those that are excludable (e.g. encoded satellite TV transmission). The non-excludability property of information introduced the problem of "free-rider". This occurs when people do not pay the cost but still gets the benefit of an information good or service.

- *Information as experience good*. Experience goods are goods whose quality or value is revealed only when the good is consumed (Shapiro & Varian, 1999). For example, the consumer doesn't know whether or not she will enjoy a movie or a live performance of opera until she has seen the movie or experienced the performance. From the viewpoint of social welfare, limited information can lead to suboptimal consumer choices and decrease the incentives of companies to invest in quality, thus lowering social welfare (Stiglitz, 2002).
- *Information goods are infinitely expansible*. Arbitrarily many copies of information good can be manufactured at a low or zero cost. This property leads to an interesting phenomenon, highlighted by Herbert Simon as "a *wealth of information creates a poverty of attention*" (Simon, 1997).

The economic properties of information have substantial importance in order to analyze the particularities of cost and value of information goods.

4. COST AND VALUE OF INFORMATION

Information has become a commodity and is regarded as an important input in production that can be measured. However, information has certain characteristics that differentiate it as an economic good that suggest that the value and pricing of information goods need special attention. Furthermore, the value of information plays a fundamental role in the economy. An information economy is based upon the premise that information has economic value and requires an information marketplace in which such value can be exchanged (Branscomb, 1994). As noted above, information is a distinctive good. Its unique features are evident even in typical cost considerations. The production of information for distribution is characterized by a high fixed cost (the cost of acquiring or developing the information in question) and an essentially zero variable cost. A good example is given by Shapiro and Varian (1999), who state that cost of production is dominated by the "first-copy costs." Once the first copy of a book has been printed, the cost of printing another one is only a few dollars. This means that once the first copy of the information has been produced, additional copies cost essentially nothing. In economics terms, the fixed costs of production are large, but the variable costs of reproduction are small. This zero variable costs reflect information's distinctive characteristics of being essentially non-material and infinitely reproducible. A parallel view on total production cost of a standard good and an information good is shown in figure 1.



Figure 1. Total production cost – non-information good vs. information good

Source: Varian (1998)

The main statement that derives from the cost characteristics of information goods is the following: *information is costly to produce but cheap to reproduce*. The atypical cost structure of information goods in competitive markets result in their marginal cost. Knowing that price is the quantity of payment for an economic good, competitive markets drive prices of all economic goods towards the marginal cost. Information goods tend to have high fixed costs but low marginal costs. This means that creating the first copy is expensive but making a copy is relatively inexpensive (Ponelis, 2007). In other words, producing the first copy of information good involves a large fixed cost F , and a small marginal cost c . This has the consequence that free competition in the market for information goods would lead to a market failure: If information goods could be sold freely, their price would sink to the marginal cost of production (which is zero in the case of the goods which are available on the Internet) and there would be no incentives for paying the fixed cost F , and for producing information goods. Therefore, another statement is derived: *the marginal cost of producing for information good is typically tend to zero due the fact that its multiplication is infinitely with low costs*.

It should be note that there is a different approach of the marginal cost of acquiring information. The marginal cost of acquiring additional information increases because individuals may have to

travel greater distances to check prices and services, and also, the opportunity cost of their time increases as they spend more time acquiring information. Thus, the marginal cost of information usually increases as more information about a product is obtained. As it shown in figure 2 the marginal cost curve for additional information slopes upward. Analyzing the marginal benefit it can be observed that it is relatively large at first, but as more information is gathered, additional benefit decreases. We are speaking about the optimal amount of information which is founded where the marginal benefit of information just equals the marginal cost of information. This level of information is identified as perfect information (figure 2).

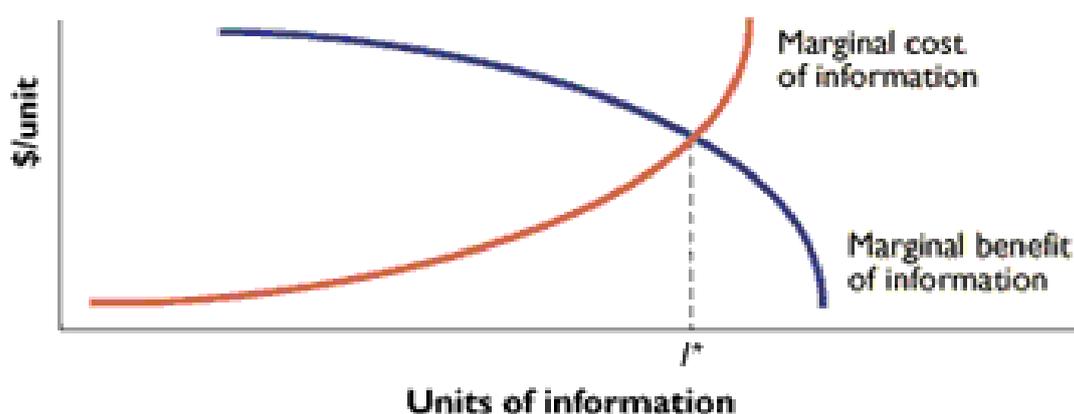


Figure 2. Marginal cost and marginal benefit for acquiring additional information

Source: Varian (2010)

The above considerations lead to the following key-points (Shapiro & Varian, 1999):

- Information is costly to produce but cheap to reproduce.
- Once the first copy of an information good has been produced, most costs are sunk and cannot be recovered.
- Multiple copies can be produced at roughly constant per-unit costs.
- There are no natural capacity limits for additional copies.

Another main issue is related to the value of information. The question of value in information has been addressed from many perspectives. Considerable studies (Krugman & Wells, 2008) are devoted to refer on informational goods that are products whose values come not from their physical characteristics but from the information they embody. Because replication and distribution costs for the copies after the original are essentially zero online, the price of information goods is not based on cost but on the value attached to the good by individual customers (Jordan, 2012).

The value of an information good, X , can then be expressed as the expected value to be gained from the use of that information good, or expressed as

$$\text{Value of } X = E[\text{use}(X)].$$

The use of expected value enables the analyst to treat the value of information goods as fixed. According to (Bates, 1990), there is a degree of variability inherent in this conceptualization of value in that the value of the information good X is still dependent upon context and the differing tastes or preferences of the parties involved.

It can be noted that the production and consumption of information goods are marked by substantial externalities or impacts. For many information goods, there are positive network effects associated with the use of the good. Suppose there is only one person in the world which has an e-mail address. An e-mail account derives its value only from the fact that other people also possess e-mail accounts so that they can exchange messages between them. The more people who have an e-mail account, the more valuable an electronic messages interchange is. This phenomenon, in which a good's value to an individual is greater when many other people own or use the same good, is common in technology-driven sectors of the economy. This is called a *network externality*.

Positive network effects are present if consumer's utility from a good depends on the number of other consumers that use the good. Many information goods, such as social media, software, payment innovations, games, mobile operating systems and even music exhibit direct or indirect network effects. Internet business models are typically multi-sided platforms. For multi-sided platforms, network effects are particularly important (Rochet & Tirole, 2006). The model of network effects is shown in figure 3.

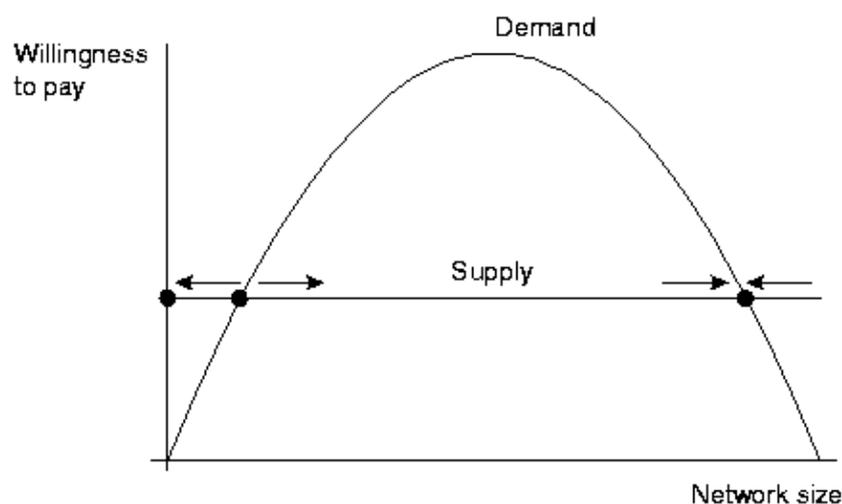


Figure 3. Model of network effects

Source: Easley and Kleinberg (2010)

When positive network effects are present, it is common that the size of the network grows gradually until a critical mass is reached after which the market size suddenly explodes. The nodes of an information network are network goods in this sense, since their value increases with the size of the network. Communications technologies are a prime example: telephones, e-mail, Internet access, fax machines, and modem all exhibit network externalities. It is well known that network effects lead to demand side economies of scale and positive feedback. The cost structure leads to substantial *economies of scale*: the more you produce, the lower the average cost of production is. In the same time, the principles of network effects have implications on market dynamics that reflects in *positive feedback* of information. This means that as more information is disseminated, the more value is gained by each user. According to (Shapiro & Varian, 1999) positive feedback makes the strong get stronger and the weak get weaker, leading to extreme outcomes. The usefulness of competing system offered by Microsoft and Intel is derived from the great number of users, in contrast with the Linux system which has a lower perception across the users. Starting from these characteristics of information goods it can be concluded that:

- The value and the quality of information are uncertain. Value of information good is based on the utility derived from the consumption of the good. Consequently, the quality of information good is revealed during its consumption.
- The cost of reproduction an information good is negligible. That way, the price of information is reflected on its value, not on its cost.
- The certain characteristics that distinguish information good from other economic goods give rise to the “free-rider” problem. Consumers can take advantage of public goods without contributing sufficiently to their creation.

4. CONCLUSIONS

Given the development in economies, information has become a commodity and as a result the value of information is important. Information, however, has certain characteristics that distinguish it from other economic products and services and which lead to an atypical cost structure, namely that the marginal cost tends to zero. Since competitive markets will drive prices toward marginal costs, the prices of information goods tend to zero.

Furthermore, because of the nature of information leading to sub-optimal markets, the value of, and therefore also ability to charge a price for, information must be protected, which is enforced legally through intellectual property rights. These rights also serve to stimulate and support the creation of information in societies and economies.

Information is clearly a peculiar economic good. Its distinctive nature and features have contributed to its problematic treatment in economic theory. The challenges of information market are addressed both producers and consumers of information goods. Which are the best strategies for increasing the value of information? Which are the advantages derived from the network effects and how they should be exploited? Here are only a few questions that economists must answer, in order to achieve competitiveness in the market of information.

REFERENCES

- Bates, B.J. (1990). Information as an Economic Good: A Re-Evaluation of Theoretical Approaches. In B. D. Ruben & L. A. Lievrouw (Eds.), *Mediation, Information, and Communication. Information and Behavior* pp. 379-394. New Brunswick, NJ: Transaction.
- Branscomb, A.W. (1994). *The economics of information – public and private domains of information: defining the legal boundaries*. Retrieved September 12, 2014, from <http://www.asis.org/Bulletin/Dec-94/branscom.html>
- Craig, R. T. (2008). *The International Encyclopedia of Communication Vol. II*, Oxford, UK: Blackwell Publishing.
- Easley, D & Kleinberg, J (2010). *Networks, Crowds, and Markets: Reasoning about a Highly Connected World*. Cambridge University Press.
- Gartner (2013). *Market Trends: Worldwide Consumer Technology Spending*. Retrieved 16 June, 2014 from <http://www.gartner.com/DisplayDocument?id=2058016&ref=clientFriendlyUrl>
- Huffman, E.E (2009). Does Information Change Behavior? *Contributed Paper for the 3rd OECD World Forum on Statistics, Knowledge and Policy*. Busan, Korea, October 27-30.

- Jones, C. I (2002). *Introduction to Economic Growth*. New York: Norton & Co
- Jordan, J.M. (2012). *Information, Technology, and Innovation: Resources for Growth in a Connected World*. John Wiley & Sons.
- Krugman, P., Wells, R. & Graddy, K. (2008). *Economics*. New York: Worth Publishers.
- Makowsky, L. & Ostroy, J. L (2001). Perfect competition and the creativity of the market, *Journal of Economic Literature*, 39, 479-535.
- Ponelis, S. R. (2007). Implications of social justice for the pricing of information goods, *International Review of Information Ethics*, 7, 216-220.
- Quah, D. (2003). *Digital Goods and the New Economy*. CEP Discussion Paper, Centre for Economic Performance, London School of Economics.
- Rochet, J. C. & Tirole J. (2006). Two-Sided Markets: A Progress Report. *RAND Journal of Economics*, 37(3), 645–667.
- Shannon, C. (1949). *A Mathematical Theory of Communication*. University of Illinois Press.
- Shapiro, C. & Varian, H. (1999). *Information Rules: A Strategic Guide to the Network Economy*. Boston, Massachusetts: Harvard Business School Press.
- Simon, H. (1982). *Models of bounded rationality: Behavioral economics and business organization* vol. 1; 2, The MIT Press.
- Simon, H. (1997). Designing Organizations for an Information-Rich World. In D.M Lamberton (Ed.), *The Economics of Communication and Information*, Cheltenham.
- Stiglitz, J.E. (2000). The Contributions of the Economics of Information to Twentieth Century Economics. *Quarterly Journal of Economics*, 115: 1441-1478.
- Stiglitz, J. E. (2002). La connaissance comme bien public mondial. In I. Kaul, I. Grunberg, M. Stern, (Eds), *Les Biens publics mondiaux*, (pp. 157-176), Paris, Economica.
- Varian, H.R. (1998). *Markets for information goods*. Retrieved April 20, 2014 from <http://www.sims.berkeley.edu/~hal/Papers/japan/index.html>
- Varian, H. R. (2010). *Intermediate Microeconomics: A Modern Approach* (8 ed.). New York: W.W. Norton & Company.