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Prices

Rumblings from Communication Theory and A More Complete Evaluative Framework for Price Discovery Mechanisms

by

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Abstract

Price discovery mechanisms (PDMs) have been evaluated using an ex post methodology whereby pricing and technical efficiencies are analyzed using results generated from the PDM. Incorporating themes from communication theory, the linkage between price discovery and price determination emerges and a PDM can be analyzed ex ante.

Rumblings from Communication Theory and

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In recent years, a proliferation of technologies and ideas have contributed to an increasing array of price discovery mechanisms. These include electronic markets (tele-auctions, computerized trading systems, video auctions, etc.) and computerized information (bulletin board based) systems. The success or failure of many of these innovations is highly uncertain and the underlying theoretical basis for the superiority of these mechanisms remains largely uncharted. The purpose of this paper is to draw upon recent advances in communication theory to present a map that may contribute to a clearer perspective in the analysis of price discovery mechanisms in a rapidly changing technological environment.

The thrust of the paper will be to present the problem, introduce a communication perspective that expands the framework used to analyze the pricing component of different price discovery mechanisms (PDMs), and give an abbreviated example of the use of this framework to compare two PDMs.

The Problem

Effective analysis of price discovery mechanisms starts with better understanding of the difference between price discovery and price determination. Price discovery refers to a process by which buyers and sellers arrive at a specific price while price determination deals with the theory of pricing and the manner in which economic forces influence price under alternative market structures and over time (Forker, p. 4).

Price discovery mechanisms are composed of institutions, structural arrangement (rules and regulations), and communication tools. They provide the environment in which the forces behind price determination interact to discover price at a point in time.

Historically, price discovery mechanisms have been evaluated as related to the pricing and technical efficiency generated. This has always been an ex post methodology. With regard to pricing or allocative efficiency, price accuracy, price levels, price variance and price bias are criteria used to compare different price discovery mechanisms. Most examples of economic analysis concerning the performance of different agricultural price discovery mechanisms have been generated from experimental economics (Chamberlin, Smith, Vickery, Bucolla) and applications of electronic markets (Schrader; Russell; Hamm et al.; Rhodus et al.; Mahoney; Holder; Bessler and Schrader; Etheridge and Matthews; Purcell).

Price theory does not explain price discovery, nor does it help to estimate the impact of alternative PDMs on pricing performance. This inadequacy can be traced to a fundamental flaw in the development of economic theory. Consumers do have preferences and budget constraints that effectively determine demand, while producers encounter costs and production techniques that determine supply. But neoclassical price theory ignores a crucial aspect in its mathematical determination of general equilibrium. Individuals and firms possess information about themselves and other situations. It is in the exchange of this information that prices are discovered.

Buchanan, in 1964, addressed this flaw and suggested placing the theory of markets at the center stage of economic theory development. Morgenstern reiterated this point when he noted that the formation of prices is not explained by current general equilibrium theory, and he included it among the great unresolved issues in contemporary economic theory. Boulding asserted that prices are determined in sum by the communication system and not by the mechanics of the market. Although the

theme of defining price discovery in terms of communication theory and systems has long been championed by Purcell, little research in this reoriented context has been done. Furthermore, there have been major developments in communication theory since Purcell used it to analyze the beef marketing system in 1966.

Thus, the primary problem is theoretical. If communication and price discovery are so important, why do we continue to evaluate PDMs solely on ex post results? The answer is because economic theory is bound in a mechanical perspective, i.e., price determination. If Buchanan, Morganstern, and Boulding are correct in their suspicion, then a new theoretical perspective is needed. That perspective must be one that centers around information and communication.

A Communication Perspective

The goals of communication theory are to explain the communication process and to analyze the communication structure of a system. To accomplish these goals, three tasks are necessary. First, the concept of information must be explored. Second, a model to represent the communication process is needed. Third, a method must be devised to analyze the communication structure of a system. The theory becomes operational with these three components--substance, model, and method. Much of the material on communication is from Rogers and Kincaid's Communication Networks.

Information lies at the base of the conceptual framework, but closely related concepts, such as meaning, understanding, and value are also crucial to establishing a foundation. Information is defined as data in the context of a particular decision (Everest, p. 164). Context is important, not only in a physical context but also a psychological

context. The physical context relates to form, structure, and shape while substance relates to the psychological context.

Meaning lies within the psychological context of information and is derived from information as persons communicate. Perception and interpretation are the processes that transfer meaning. Perception bridges the gap between the physical and psychological levels of reality while interpretation follows perception and is the psychological registering of information. Since individuals have different interpretational bases, communication serves to equilibrate interpretation and contributes to mutual understanding which is necessary for a social decision like an economic exchange to occur.

The effort to maintain meaning in a world of increasing knowledge and information has included several responses. These responses are related to three characteristics of information--organization, standardization, and completeness. Each of these characteristics have evolved from the basic problem of extracting meaning from information and knowledge. Furthermore, organization, standardization, and completeness contribute value to information. Organized information is superior to unorganized information and organization is a service applied to information. Standardization also contributes to better communication and lowers uncertainty. Completeness of the information sets is important, especially in a social context where information is released voluntarily. Here, completeness is never perfectly attained, yet there are threshold levels which are necessary before enough information is available to make a decision. The informational requirements of economic markets function to reveal these threshold levels. In fact, markets are no more than structured, organized, standardized information centers where information transfer is fluid and efficient.

Associated with information transferal are costs. The most expensive form of human information transferal is face-to-face verbal communication. This entails transporting the individual who possesses the information to a place where the transfer can occur. The limits of time and space are overcome by a large application of energy to matter. If the information is transferred separate from the individuals, the cost drops drastically. Because there is a trade-off between cost and degree of intimacy in information transferal, a decision is made by the individual as to the mode of information transferal depending on the purpose at hand. A key consideration is feedback and this is where communication becomes important.

Communication is a process that can be portrayed by the convergence model where information and mutual understanding are the dominant components (figure 1). At the individual level, information processing involves perceiving, interpreting, understanding, believing, and action. The process creates new information. Mutual understanding, mutual agreement, and collective action may evolve when information is shared by two or more participants. Likewise, misunderstanding, disagreement, and conflict have a probability of occurring.

Human systems are coordinated and connected by the exchange of information rather than by mechanical means or by force of matter and energy (Watzlawick et al.). Therefore feedback is crucial and is a process over time where information changes and there are several cycles of information exchange. It is with respect to the temporal aspect of feedback that the time cycle of information exchange becomes a concern. Kendrick has proposed that the evolution of economies have exhibited quickening cycle times of information exchange. The time cycle of information exchange can be extremely important when a social decision

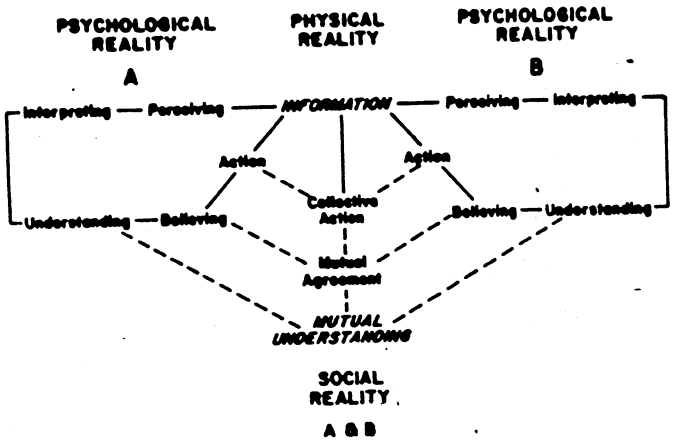

Figure 1. Basic Components of the Convergence Model of Communication

Source: Rogers and Kincaid

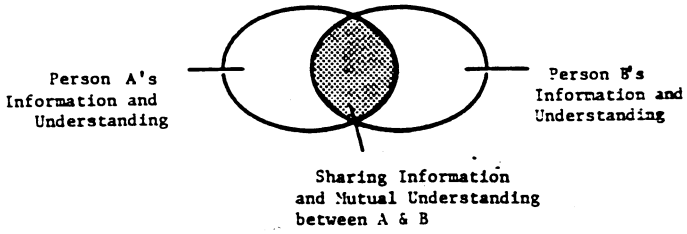

Figure 2. Communication as Convergence Toward Mutual Understanding

Source: Rogers and Kincaid

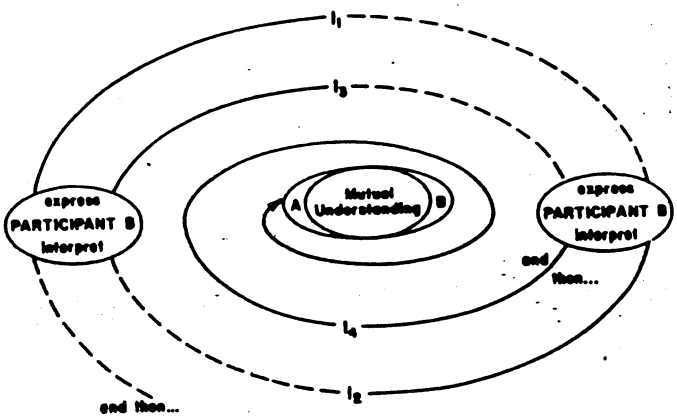

Figure 3. A Convergence Model of Communication

Source: Rogers and Kincaid

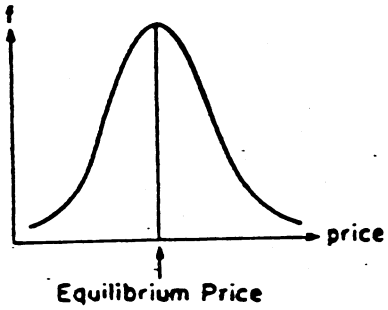

Figure 4. A Joint Probability Density Function Associated with the Exchange of Information Concerning Price

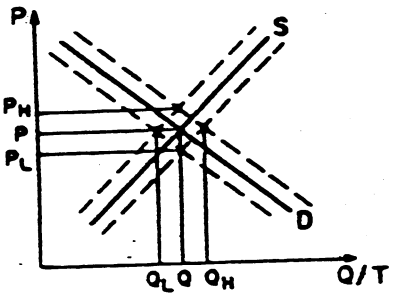

Figure 5. Price Determination Emanating from the Exchange of Information Considering Probability Density Functions Associated with Price

such as an economic exchange takes place, and the opportunity costs of the participants are high. Due to the inherent uncertainty of information exchange, the probability of mutual understanding may be increased by several cycles of information sharing about a topic. Figure 2 depicts sharing of information and mutual understanding between two persons. The intersection of the circles connotes shared information and mutual understanding.

The model of convergent communication is depicted in figure 3 and reflects the circular nature of information exchange and the convergent nature of mutual understanding. The process begins with "and then" to signify a past. Person A shares information (I_1) with person B. Person B may respond by creating information (I_2) to share with A. This process continues ($I_3 \ldots I_n$) until one or both become satisfied with their understanding of the topic.

Uncertainty plays a role in mutual understanding. Tolerance, or the amount of variation allowed for some level of accuracy, is also an important concept in the convergence model (Bronowski). Most specific purposes require certain limits of tolerance to be attained before communication stops and the task is completed. Iterations of information exchange between participants in a communication process contribute to understanding of meaning and greater accuracy in perceiving and interpreting.

Therefore, an understanding of the convergence model of communication must take account the characteristics of the transferred information, the time cycles involved in the information exchange, and the tolerance levels necessary for social action. Criteria for each of these factors have been devised and used to evaluate PDMs.

Communication between individuals follows the process represented by the convergence model. Yet, the network of communication determines the structure of a communication system and this can be examined through the characteristics of the network. A method of research, communication network analysis, is used to identify the communication structure in a system.

A link is a communication relationship between two units in a system and is the basic datum in any type of network analysis. A direct communication link is usually operationalized by asking a question such as: "With whom in the system have you talked most frequently about topic X?" (Rogers and Kincaid, p. 97).

A fundamental step in identifying communication structure is to measure various dimensions of the structure through the conceptual variables of connectedness and openness. These variables are operationalized by measuring proximity which is the relative nearness of a pair of individuals to each other in a communication sense. A measure of proximity indexes whether two individuals communicate directly and how closely tied they are through other individuals.

Connectedness is defined as the degree to which a member of a system is linked to others in the system. To operationalize this concept in a system context, average system connectedness is measured, which is the degree to which an average member of a system is linked to others in the system. Openness is related to the degree to which members of a system are linked to others external to the system. A more open system is expected to be ingesting new and different information.

To summarize, communication theory provides criteria to evaluate both the microscopic and macroscopic aspects of communication. At the microscopic level, the convergence model, with its focus on the

communication process, leads to criteria based on the characteristics of information, the time cycle of information exchange, and tolerance levels needed for social action. At the macroscopic level, communication network analysis, with its focus on communication structure, leads to criteria based on the characteristics of the structure, which are connectedness and openness. These criteria are basic for evaluating a communication system, of which a PDM is an economic subset.

Price Discovery and Price Determination

The process that occurs in some agricultural PDMs, such as in private negotiation and auctions, resembles the convergence model of communication in a network context. The mutual understanding that results from the convergence process creates a sharing of information about the price of a product. Figure 2 illustrated this sharing of information. With this in mind, a joint probability distribution may be thought to exist with respect to price. This is depicted in figure 4. It is hypothesized that there is a relationship betwenn figures 2 and 4. That is, if the probability distribution is centered on the equilibrium price, then the sharing of information serves to decrease the width of the distribution. With less sharing of information, the width of the distribution would tend to widen signifying increasing uncertainty as to the accuracy of the discovered price. This principle has been empirically verified by Buccola in his experiments with centralized and noncentralized trading. The skewness of the joint probability distribution would also be affected by the sharing of information. If one participant or group of participants (sellers) shared less information while at the same time gathered more information from their opposite participants (buyers) then one could expect the distribution to be skewed toward the participant with the informational advantage. This principle has been empirically verified by

Smith in his experiments with different pricing rules and by Hamm et al. in their evaluation of an electronic market for livestock.

Price determination accommodates the communication perspective through the joint probability distribution inherent in price discovery. This is shown in figure 5, where there exists probability distributions surrounding the supply and demand curves. These distributions relate to the uncertainty associated with the price discovery information inherent in these curves. Notice that rather than an equilibrium price, there exists a range of "exchange" prices that correspond to the probability distributions. As the probability distributions narrow, the range of "exchange" prices narrow. This is defined as price accuracy. Thus, information better understood and communicated throughout the system results in prices that more accurately reflect the economic forces at work. Since perfect information is assumed behind the formulation of an equilibrium price, the above perspective is a logical relaxation of that assumption.

Price levels fit in this framework with respect to the discovered price which may or may not be an equilibrium price. Here again circumstances or situations may bias the discovered price away from the equilibrium price. Unequal sharing of information can translate into unequal mutual understanding. Buccola labels a mean price different from the equilibrium price as price bias. Insider information possessed by an individual or firm can translate into bargaining power, and the result can be an enhanced price to the one with the advantage. The advantage may not necessarily be translated through an increased price. Other factors involved in the exchange, such as credit terms, may be used to make the trade advantageous to the trader with superior information.

The previous discussion on communication relates to pricing efficiency through the information and mutual understanding links. Rather than measure pricing efficiency after the fact of the price discovery process, the communication perspective offers an explanation for those results. Using the principles inherent in that explanation, the communication criteria may be used to predict the resulting pricing characteristics of a PDM.

Pricing accuracy can be specified as the primary objective in a price discovery mechanism. With this in mind, the characteristics of information-- organization, standardization, and completeness, along with the two characteristics of a network--connectedness and openness can be used as criteria in evaluating a PDM.

The Expanded Framework

The framework used to evaluate PDMs can be summarized as being in the shape of a pyramid. At the base of the pyramid are information, the communication process, and the communication structure. Next comes the economic concepts of price discovery and price determination. As a specific PDM is examined, the pricing and operational efficiency of the mechanism may be evaluated taking into account the functional performance and cost of the mechanism. The resulting economic efficiency of the PDM can then be ascertained.

The framework was applied recently when the telephone trading system (TTS) currently used in the cash grain industry was compared to a conceptual computerized trading system (CTS) for grains (Turner).

Using communication performance to evaluate effectiveness, the results indicated that a CTS was the most effective system with respect to the criteria for information. With respect to criteria for the time cycle of information exchange, a TTS appeared most effective on a dyadic

level, while a CTS was superior on a global level. As far as tolerance levels, no difference between the two PDMs was expected. When the characteristics of the network, connectedness and openness, were examined a CTS appeared to be the superior PDM.

Overall, the CTS appeared to perform superior in a communication context. Of course, the functional and cost performance must also be evaluated before definitive comparisons are complete.

Summary

The communication perspective allows analysts to evaluate PDM's ex ante. That is, using communication performance criteria alternative PDM's can be examined to determine communication efficiency. Incorporated with functional and cost performance, a superior evaluative framework evolves. This framework can be valuable in directing empirical studies to collect data on the communication characteristics of a PDM, in addition to the functional and cost performance of a PDM.

Furthermore, quantitative results of communication performances of various PDM's have never been gathered and analyzed. This is the next major step in operationalizing communication theory into the evaluative framework of PDMs. But with the perspective developed here, this step is nearer to being hurdled.

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