Markets and Marketing on the Information Highway

Potential Effects of Information Technologies on the Economic Performance of Agricultural and Food Markets

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The structural characteristics of a perfectly competitive market are well known:

- Many buyers and sellers.
- Homogeneous product.
- Perfect information.
- No barriers to entry.

It is widely believed that the closer a market approximates perfect competition, the more economic welfare is improved.

Many studies have shown that agricultural and food marketing systems in the United States and throughout the world are not perfectly competitive (Connor et al.), and are becoming less so over time, with the possible exception of formerly communist countries.

These deviations from perfect competition result in measurable welfare and consumer losses (Parker and Connor; Connor and Peterson). However, new information technologies, and the Internet in particular, have the potential to improve the economic performance of agricultural and food marketing systems by affecting almost every structural characteristic of these markets.

This paper will outline some of the ways in which information technologies may affect the structure of agriculture and food markets, and draw implications for the performance of those markets.

Transactions Costs, Market Thinness, and the Role of Arbitrage

Information technologies improve economic performance primarily by reducing transactions costs and market thinness. Due to the widespread availability of electronic information and communication systems, transactions costs will decline, and markets should more closely approximate the structural norms of perfect competition. Although economists have long recognized the importance of transactions costs in influencing market performance (see Kilmer and Armbruster), little research on agricultural market performance has been conducted that specifically includes a consideration of market thinness and transactions costs (Turner and Nelson).

A thin market may be defined as a market in which the structure of the market inhibits or prevents prices across space, time and form from attaining the relationships characteristic of a perfect market (also see Hayenga for definitions and discussions of thin markets). Traders in thin markets may behave competitively or uncompetitively depending on their ability to exercise market power. The structural causes of thinness include:

- Low trade volumes.
- Few buyers or sellers.
- Scarcity of market information.
- Barriers to entry.
- Certain forms of government market intervention.

Most, if not all, real world markets do to some degree have at least one of the structural features of a thin market—for example, useful information is rarely free. But, these features are more pronounced in thin markets. The dominant presence of one or more of these features in a market results in significant transactions costs which make conventional arbitrage risky or costly to would-be traders. The limited performance of arbitrage in thin markets results in prices that seemingly are not efficient; that is, prices often do not react to changes in market conditions as they would in a perfect market.

Market prices are generated by the transaction between buyer and seller. The buyer and seller decide how high or low a price each is willing to pay or receive for the commodity traded. That price reflects a judgment by each that the price will either maximize expected profits or expected utility given the constraints faced by the buyer or seller. (Also see Buccola for a discussion of the pricing decisions of market participants). The pricing decision is partly based on each trader's perception of price distributions that either will prevail in the future, currently prevail in other markets, or have prevailed in the past.

In a competitive environment, traders are willing to bid or offer prices up to the point at which a transaction yields no evident profit. This process is called arbitrage. Traders in perfectly competitive markets base their arbitrage decisions on perceived distortions in price from efficient, or least cost, relative price relationships. Thus, in perfect markets, traders can expect that prices across space, time and form will differ at most by minimum marketing, processing or transfer costs.

Traders may also be willing to trade on the expectation that price levels will change in the future. In such cases, traders speculate that there is an arbitrage opportunity contained in today's price level. Traders may also speculate on changes in relative price relationships. But speculation is most commonly thought of as taking a position on the expectation of an absolute price change, that is, without reference to the configuration of relative prices.

As long as there is an element of risk in a trader's evaluation of expected profit, all arbitrage is a form of speculation. Conventional arbitrage is less risky because it relies on a trader's knowledge of all prices and costs involved in a transaction. Speculating on changes in absolute prices is, in general, far riskier because a trader gambles on his/her evaluation of future price levels. Because real future price levels in a competitive environment are determined by exogenous or uncertain events, such as weather and political decisions, both the risk and potential rewards to price level speculation are larger than to conventional arbitrage.

Due to arbitrage and speculation, in the long run, absolute prices under perfect competition represent minimum production costs. Current price levels contain all information available to the market; that is, prices attain equilibrium. When prices are pulled out of equilibrium by unanticipated events, or shocks, arbitrage corrects prices to a new equilibrium. Thus, there are only two forms of profit making in a perfect market: 1) speculating (accurately) on an event not

anticipated by the market (assuming perfect knowledge does not include perfect foresight), and 2) arbitraging price discrepancies that occur as a result of a shock to the market.

The trading environment that promotes arbitrage is one in which transactions costs and other barriers to entry are low and market liquidity is high. If a trader has any difficulty in finding a buyer (or seller), in obtaining market information, or if his/her transactions disturb price, he/she incurs transactions costs. Transactions costs discourage trading because they make the expected returns to arbitrage more variable and potentially lower. Thus, a price relationship that appears profitable may not be arbitraged if traders fear that the return to arbitrage may not be realized. If perceived transactions costs exceed the value of the price discrepancy, traders will not arbitrage.

In active markets, market makers hold inventories for only very short time periods—often just a matter of moments—between purchase from a seller and sale to a buyer. The momentary supply and demand for actively traded goods are highly elastic. Moreover, there is likely to be competition between market-makers in an active market. Hence, the marketing margin is very small in active, liquid markets. In thin markets, both would-be buyers and sellers and market makers are scarce. The market maker in a thin market will buy at prices relatively lower and sell at relatively higher prices reflecting the inelasticity in the supply and demand for the thinly traded product. The market maker in a thin market may also earn some monopoly rents if other market makers are not attracted to the thin market. However, if the margin is too large, would-be traders will bypass market makers and directly incur the transactions costs in finding other traders. In other words, traders will vertically integrate if market makers do not behave competitively (see Kilmer; Barry, Sonka and Lajili for further discussion of vertical integration in agricultural and food marketing). Thus, the wide marketing margins characteristic of thin markets generally reflect the costs, including those associated with the risk of further shifts in supply or demand, of marketing in a thin market.

Information Technologies Reduce Transactions Costs

A number of conditions improve market performance by reducing transactions costs and increasing market liquidity. Many of these conditions will be fostered or enhanced with widespread use of information technologies. For instance, competitive market makers promote liquidity by temporarily inventorying goods and earning revenues from the usually small difference between their purchase and sale prices. They provide an environment in which relative price arbitrageurs and speculators can easily find someone to buy from or sell to at prevailing prices. Thus, they facilitate other forms of arbitrage. If their costs decrease through the use of information technologies such as electronic inventorying and ordering systems, the difference between their purchase and sale prices should decrease, and arbitrage is further promoted.

The availability of futures trading vastly increases the informational efficiency of a market. By providing an environment in which transactions costs are lower than the costs of trading the physical commodity, and in which leveraging power is high, futures trading promotes arbitrage. Market makers in futures markets, "scalpers," also provide

immediate liquidity by offering to buy and sell futures contracts at prices separated by their bid-ask spread. Insofar as these effects lower transactions costs, the prices determined in a futures market will contain at least as much information as prices determined in a market for a commodity without futures trading. Traders outside of the futures market benefit from futures trading because they can look to futures prices as a source of market information. Therefore, the market for a commodity without futures trading is likely to be thinner than the market for a commodity with futures trading.

A number of information technologies are being rapidly adopted in organized futures markets. Besides cost-reducing electronic order entry, record keeping, and clearinghouse operations, futures exchanges are also adopting information technologies that facilitate traders' access to information. Both the Chicago Mercantile Exchange and the Chicago Board of Trade have well-developed homepages on the Internet. The Chicago Board of Trade has recently reduced the time delay of publicly available futures price quotes from fifteen minutes to ten. Besides publicly available information through sources such as the Internet, both exchanges make price information available commercially through Reuters. There are also many other commercial information services that relate to financial and commodity futures markets. However, it is very possible that the role of these services will decline as "free" information becomes more user-friendly and widely available over the Internet.

The financial and futures exchanges appear to be learning that they can promote use of their markets, and increase liquidity, by reducing information barriers to entry. Most members of futures exchanges are to some degree market makers who thrive on volume, not on risk. They avoid thin markets. Market makers prefer to enter into and reverse, positions quickly, earning small profits on many transactions (Silber). They are reluctant to take a position when they may incur high transactions costs, or significant inventorying time, in reversing that position. Moreover, the probability of a change in price levels, or price risk, increases with time.

The Internet will also promote arbitrage in small or niche markets by making it easier to identify buyers and sellers, obtain information about current supply and demand conditions, and monitor and establish price. A trader may at times earn rents from trading in a market in which other traders are reluctant to arbitrage, especially if that trader has access to information others do not. However, on average, rents should be less than or equal to the transactions costs of "uninformed traders," or else these traders will enter the market up to the point at which perceived transactions costs equal arbitrage profits. (See the related issue of "contestability" as proposed by Baumol et al.). An example of a thin market with low trade volumes is the market for specialty and organic food products. The Internet will reduce opportunities for information rents and will increase market access and awareness of buyers and sellers thereby reducing thinness. There are already many examples of Internet sites that provide such market information. While such systems have existed for some time in the form of "electronic bulletin boards," they never really took off until the development of the user-friendly World Wide Web.

The Internet will increase market information and reduce transactions costs associated with shopping for consumers as well as for food and agri-businesses. It will be increas-

ingly reasonable to expect consumers to become grocery arbitrageurs.

A number of food stores already have World Wide Web sites with price and nutrition information for all food items. Grocery shoppers can click the products they want to purchase on an electronic "form" at these Web sites, charge the purchase to their credit or debit card, and have this bundle delivered to their home or made ready for pickup at their convenience.

This is really not that much of a technological leap considering that bar codes, electronic inventory, and scanning technology have become widely adopted in the food retailing industry. Databases that were previously used primarily for internal purposes now may be used to attract and transact business with consumers.

The Internet will also mediate the paucity of market information that often occurs from a separation of the trading environment from producing or consuming locations, especially when producing regions are in less developed countries.

Historically, if the returns to arbitrage have been great enough, that is, if prices are sufficiently and chronically distorted, private or governmental agencies have released or sold information regarding market conditions. Coffee and cocoa are commodities for which accurate supply information has at times been difficult or costly to obtain.

The Internet will not make it easier to collect this information, although satellite imaging probably will, but the Internet will make it easier to disseminate information collected from a location to any other location on earth. Examples of such information sites on the Internet already exist.

Marketing Margins, Economic Performance and Information Technologies

As Grossman and Stiglitz demonstrate, an informationally efficient market is logically impossible. What distinguishes a competitive thin market from a market closer to perfect competition is that high transactions costs discourage transacting and result in price relationships that differ from perfectly competitive norms by an amount less than or equal to the cost of transacting.

Price relationships in competitive thin markets are analogous to those in inter-regional and inter-temporal trade models in which prices differ at most by the cost of transfer (transportation, processing or storage costs) between two markets.

Let M represent the difference in prices at markets separated by space, time or form. When trade or marketing occurs, M is the marketing margin.[1] T represents the minimum marketing costs, including a normal return, that would be incurred in transportation, storage or processing. T may differ between economies for a particular marketing activity depending on available technologies and the scale of marketing activity. There exists a T_{min} for each marketing activity at an optimal scale and most efficient technology. H represents transactions costs incurred as a function of market thinness. R represents monopoly profits associated with imperfect competition. Finally, W represents wastage associated with technical inefficiency and imperfect competition in marketing. W is analogous to Scherer's "X-inefficiency."

When marketing occurs, M is the sum of T, H, R and W:

$$M \equiv T + H + R + W.$$

In a perfect market, $M < T$ if no marketing occurs, and $M = T$ with marketing. If scale economies are important, $T = T_{min}$ under ideal efficiency conditions. In a market that is thin, but competitive and efficient, $M < T + H$ if no marketing occurs, and $M = T + H$ with marketing. Hence, because of transactions costs, in thin markets prices may efficiently differ by more than minimum marketing costs while no marketing occurs. Moreover, when a market is thin because of low trade volumes, T is likely to be greater than T_{min}, further increasing M.

Market performance may be evaluated by separating the marketing margin, M, into its components. A market may be considered competitive and efficient given a scale of marketing activity if R is approximately zero, indicating the absence of monopoly rents, and if W is also approximately zero, indicating that a firm is operating along an efficient isoquant. The level of H is related directly to the level of market thinness. If T and H can be identified and shown less than M, it may be inferred that either monopoly rents or waste in marketing is contributing to the size of the marketing margin. Especially when evaluating market performance in less developed countries, it is important to evaluate M with respect to the appropriate T rather than, or in addition to, T_{min}.

The use of electronic information and communications systems may reduce all components of M. Moreover, these technologies are largely scale neutral so the benefits should accrue to small as well as large businesses and individuals. Electronic inventory and order systems may reduce T. Use of the Internet and other electronic market information systems, both public and private, should reduce H. Lower barriers to entry, improved information about product qualities and availability, and greater information access could reduce R. W may be reduced through improved decision making, and less reliance on trial-and-error learning.

Finally, by increasing the potential number of buyers and sellers, electronic information and communication systems should increase the elasticities of supply and demand for a product and reduce the likelihood of transactions disturbing price.

What will be the effect of increased use of information technologies on vertical integration and coordination in the food system?

While it is certainly possible that big, conglomerated companies may be the first to adopt some of the more expensive information technologies, and may enjoy some short-run advantages in their use, most technologies are becoming increasingly affordable to even the smallest businesses and individual consumers. Therefore, it seems likely that these technologies may encourage entry and development of niche and specialty markets, and should reduce the trend toward conglomeration and integration.

That is, we may see even more marketing intermediaries if additional value or reduced costs stem from specialized marketing firms.

However, information technologies do offer increased opportunities for information sharing and coordination. These opportunities will generally be pro-competitive, rather than anti-competitive, as companies find new ways to become more efficient and serve customers better. They will not represent barriers to entry as long as new firms can develop an information interface with potential partners, and information has more value to firms when it is widely shared than closely held.

Conclusions and Recommendations

This paper has painted a rosy picture for the effects of information technologies on the economic performance of agricultural and food markets. Improvements in market performance will largely stem from reductions in transactions costs for buyers and sellers and improvements in market liquidity and efficiency. Information will become more accessible and less costly, barriers to entry will be reduced, and markets will become more competitive.

There may be some thorns among the roses however. Until access to and adoption of information technology becomes widespread internationally in rural and urban areas, there will be a disparity between "have" and "have nots." During the transition period, until access to high "bandwidth"and high-tech computing technologies is universally available and affordable, some firms will have advantages over others in their use of information technologies. These firms will be more efficient and more profitable, and may drive less efficient firms out of business. They will also be able to operate at larger scales more efficiently with information technology.

Another potential downside is that firms may not realize that information, in the long run, has more value when it is widely shared than closely held. This is a difficult notion for some industries to accept, but recent experiences in agriculture—the StratSoy project, and the increased information dissemination to the public via the Internet of previously privately held information by commodity futures exchanges—suggests that the era of informational comparative advantages may be coming to a close.

The policy implications of this analysis are that the government should promote rapid adoption of information technologies. This is true for two reasons: 1) overall economic performance will be enhanced, and 2) the transition period during which some firms will have advantageous access to, and use of, information technologies will be minimized.

There may also be a role for the government to play in encouraging greater dissemination of information to the public. The government is the primary collector of much information that is often difficult for the public to access directly. At present, many informational intermediaries collect government information, repackage it (adding some value in the process), and sell the repackaged information commercially to interested audiences. This is efficient given past information technologies. Now, however, the government may distribute much of the information directly to the public via the Internet, at no greater internal cost than it did previously, and provide the information in a more user-friendly manner at far less cost to the public. The U.S. Department of Agriculture is already doing this, as are many other government agencies, e.g., Federal Trade Commission, Small Business Administration, Internal Revenue Service, Environmental Protection Agency. Not only is this a more efficient way of providing information to the public, it also enhances the image and effectiveness of the government.

NOTES

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1. Gardner derives the behavior of the marketing margin under competition and various assumptions about the elasticities of retail food demand, farm output supply and the supply of marketing services. The component of the marketing margin that corresponds to minimum marketing costs, T, corresponds fully to the margin discussed by Gardner.

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