The Economics of Cooperation and Competition in Electronic Services Network Industries

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Technological improvements in information transmission and processing have led to the emergence and growth of networks in which information can be electronically transmitted among network users at numerous locations. These networks are called electronic services networks (ESNs) and their growth has already had profound effects on the organization of the affected industries. Their growth has created a policy dilemma because networks raise problems that economists traditionally have difficulty grappling with. Unlike many industries, atomistic competition just does not work well in network industries. Some cooperation among competitors may be essential for efficiency in a network but such cooperation is precisely opposite to the way economists usually think about generating efficient behavior. The logical underpinnings of antitrust law are based on the economist’s belief in the desirability of competition. Applying traditional antitrust concepts to network industries creates the potential for endless litigation and confusion. I think it no accident that several ESNs such as computer reservation systems (CRSs) used by airlines have already been the subject of complicated litigation.

Some ESNs enable users not only to access data but also to interact and complete transactions. For example, a travel agent can use a CRS to obtain an airline ticket for a passenger or a consumer can use an automated teller machine (ATM) to withdraw cash from a bank account. Such ESNs create “a market” and the economics of such ESNs are therefore related to the economics of “making markets,” a subject that economists have begun to understand only recently.

Many of the special economic characteristics associated with ESNs arise in other network and non-network industries. Railroads provide a particularly good
spend money on a service enhancement if the value of that service enhancement depends on the willingness of the other members of the network to accommodate the innovation? The successful innovator could be subject to opportunistic behavior by the other members of the network and be deprived of a profitable return.

When industries are rapidly evolving technologically, the cooperation needed to insure that firm A's latest equipment works with firm B's may be especially difficult to achieve if A and B are separate firms. For example, firm A may have the capability to install a fancy telephone telecommunications switch that allows it to keep track of the address of the caller and display that information to the called party. If firm B doesn't have compatibility with this service enhancement, then calls forwarded from firm B's territory will be unable to take advantage of this enhancement and the value of firm A's machine is reduced. This decrease in the value of A's machine could dissuade firm A from introducing it. Again, these problems of coordination can be solved by consolidation of firm A and B into one firm.

Standard-Setting Can Help Achieve Coordination

Standard-setting is one way to deal with the need to assure compatibility among firms. Indeed, even in an atomistic industry like steel scrap, there are certain types of grades for the product that are uniform nationally. These standards for grades are set by the industry members. Standard-setting is routine for most industries and is facilitated by the American National Standard Institute, an organization composed of trade and consumer groups that develop voluntary industry standards. However, standard-setting among independent firms works best in an industry that is not evolving rapidly technologically. Whether or not an industry is a network, technological change makes standardization difficult to achieve and subject to strategic manipulation. Standardization can retard technological change.

An example from a mature network industry illustrates the difficulty of using voluntary standards to achieve compatibility among independent firms. During the last half of the 1800s, railroads were developing new technologies—both in operating procedures and equipment. There initially were physical incompatibilities among neighboring railroads (one car couldn't ride on another's tracks, necessitating loading and reloading to ship cargo across two rail lines) and operating incompatibilities, such as failure to agree on what time it was (before 1883 there was no time standard) and failure to agree to accept another rail's billing (description of cargo). As rail lines became bigger through consolidations and came under one management, coordination and productivity improved. These larger rail systems were eventually able to achieve coordination amongst themselves. Today, the rail industry has a relatively mature technology and seems able to achieve coordination on physical and operating standards. However, if one looks at one recent area of technological improvement
is often difficult. But if price fails to equal marginal cost, inefficient network operation could result.

Second, many ESN networks provide information as one of their products. It is well known that the pricing system does not necessarily do a good job at allocating resources devoted to information. Information has aspects of a public good whose marginal cost is zero. Moreover, as discussed more fully below, there frequently can be difficulty in ESNs in appropriating property rights in information.

Third, within a network it can be enormously complicated to figure out the correct shadow price for use of one link. Technically, a complicated nonlinear programming problem is involved. It is my understanding that in network industries like telecommunications and airlines, the relevant network problems cannot be completely solved with today's technology. Moreover, there is an important theoretical result, due to Koopmans and Beckmann (1957), that states that use of uniform decentralized pricing by link may not be sufficient to sustain optimal network operation. That is, there may be no system of decentralized prices by link that allows the price system to achieve incentives for optimal network operation. Indeed, in two network industries that I am aware of, optimal network operation is solved by having a single network operator (which may be owned by participating firms). For example, in New England, electric utilities have formed the New England Power Pool, which decides how to run the network. Similarly, in railroading, a joint venture, the previously mentioned Trailer Train, is responsible for the routing of piggy-back cars through much of the U.S. railroad network. In railroading, previous attempts to achieve efficient routing of cars have typically failed unless a single agent has ownership and control of the cars. Apparently, it is too costly to use prices as the sole coordinating device to induce independent firms to provide the optimal routing of cars.

Even if it were theoretically possible to use a decentralized price system to allocate resources efficiently, it may be administratively impractical to do so. If price is not continuously varying so as to equal marginal cost, but is instead set at average cost, then in many ESNs, price will often exceed marginal cost. This creates an incentive for a firm to want business over its link in the network whether or not it is efficient for the network as a whole. In fact, it's easy to see that competing firms that own less-desirable links could also profitably serve a customer. For example, suppose a telephone call can go between points A and B directly, or between A and C and C to B. The indirect route is longer and has higher marginal cost than the direct route. Suppose that the direct route and indirect route are owned by two separate firms. If the price of sending a message from A to B is above marginal cost, it may well be profitable for the firm owning the indirect route to also send the message, even though it is the inefficient route. In short, because it is hard to have marginal cost pricing in a network, any practical pricing scheme will typically differ from marginal cost.
garding sports leagues, a joint venture of independently owned teams, is indicative of the difficulty of knowing where to draw the line between competition and cooperation.

Competitive problems also can occur when firms in the network compete with network and non-network firms at another stage of production. For example, in a telecommunications network, the electronic switches could be manufactured by firms that also own parts of the network. Concerns may arise that firms in the network could manipulate standards and operating procedures of the network to benefit themselves as suppliers of equipment. Examples would be the failure to reveal to other equipment vendors how to design equipment so as to be compatible with the network and the creation of certain requirements that make it more costly for outside firms to compete to supply equipment.

Another example involves an ESN used for marketing purposes like a computer reservation system (CRS). A CRS facilitates the purchase of airline tickets. Each airline does not have its own CRS and instead some airlines sell tickets through ticket agents who use the CRSs of other airlines. The concern has arisen as to whether the airlines that own CRSs used by ticket agents could design the operation of the CRS to disadvantage other airlines. For example, it has been alleged that some CRSs did not display information of certain airline competitors so as to reduce competition.

PROPERTY RIGHTS AND CREATION OF MARKETS

The competitive problems that arise in networks raise many complicated trade-offs that do not have an easy policy resolution. Ex post after the development of an ESN, competitors can self-righteously rail against the unwillingness of the ESN's developer to allow them to use (or supply) the system. But if other firms can use or supply the system, the returns to innovation may fall. The old trade-off between property rights in innovation and market power rears its head.

The problem of protection of property rights in innovations is especially severe in some ESN settings. The reason is that if many firms must coordinate in a network, then an innovation by one firm, as we have already seen, may be valuable only if the other firms know how to interact with the innovator. But revealing how to interact may reveal the innovator's discovery. Indeed, much of the innovation in ESNs is know-how and software. Protection of intellectual property can be difficult in a setting that demands constant interaction with your rivals.

The difficulties of protecting intellectual property arise even in mature network industries like railroads. For example, suppose railroad 1 goes from New York to Chicago to Los Angeles. Railroad 2 goes only from Chicago to Los Angeles. It is possible to ship from New York to Los Angeles by using just railroad 1 or by using railroad 1 from New York to Chicago and by using railroad 2 from Chicago to Los Angeles. Railroad 2 also has a route from New
successful firm and asks if the successful firm could also market (though not set the price of) the rival’s competing product, most economists would probably applaud if the successful firm voluntarily chose to do so. Most economists would probably not force the successful firm to market its rival’s product. For example, I doubt whether anyone would seriously propose that, if I wanted to manufacture cars, GM should be required not only to sell them but to sell them with the same effort as their own cars. Yet the history of the development of CRSs and of their subsequent litigation contains much similarity to the story I have just related. I do not wish to debate the specifics of the CRS case, but merely to point out that it is a mistake to underestimate the costs of creating information useful for marketing and to ignore that even though ex post marginal costs of usage are low, ex ante incentives are what matter for development. Indeed, after a successful system is developed, it could lower the likely costs of development of a second system because of the likely information spillovers and free riding that the second entrant can take advantage of in an ESN. The fact that no subsequent development of a competing ESN occurs could illustrate the high sunk costs of development—costs that might be highest for the initial developer.

When the Chicago Board of Trade creates a (futures) market, it is only after much research as to how to define a commodity and how to choose delivery points and dates of contract termination. Most times new futures markets fail. There often are elements of natural monopoly once a market is created. The bigger a market, the more liquidity. It is rare to have the identical commodity trading on the different futures exchanges.

ESNs that create the ability to transact have several features similar to the creation of markets. For example, in a data transmission network, the value of the network may be enhanced as the number of participants sharing information grows. If I am a car manufacturer, I would like the same network to connect me to my glass supplier and my windshield wiper supplier. When it is efficient to have only one network, it may be hard to introduce actual competition among vendors who can provide the network.

If there are many potential networks which firms can use to transact, then there can be competition to provide the network, but once in place there may be no further competition. Moreover, the initial network may have an advantage as the technology evolves and adaptations are involved. For example, suppose I supply GM with tires. I develop a terrific information system for GM that allows the scheduling of shipments and deliveries from many warehouses. I develop the system for GM so that it can be used for other products which I also sell. Such a system will undoubtedly be geared to my own supply capabilities. If I now add the ability for my system to be used for other suppliers’ parts, it is likely that the system will be automatically geared to favor my own products. Should GM be upset? After all, it could start anew and develop its own system, or could have done the system development itself. Again, the trade-off between static and dynamic efficiency is at issue.
technologies—some akin to market creation—have simultaneously raised the possibility of competitive harm from the ESNs. We should not let the concerns with competitive harm so occupy us that we overregulate and kill the incentive to continue the pace of technological change. And we should not ignore the fact that policy actions on existing ESNs will affect how future ESNs are developed. For example, if Congress were to pass a law forcing airlines to divest their CRSs so as to eliminate the possibility that one airline could harm a rival that uses its CRS, my prediction is that future developers of ESNs would protect their property rights by preventing vertical competitors from using their ESNs, thereby eliminating the possibility that any competitor could argue that its competitive success is impaired by the control of the ESN by a rival.

In summary, there are no easy answers to resolving the tension between competition and efficient network development. I predict that consumers will continue to benefit from ESNs at the same time that economic research, litigation, and controversy surrounding ESNs grow.

NOTES

Much of what I know about networks has come from my academic and consulting work with them. I have been involved in the following network industries: airlines, telecommunications, railroads, gas pipelines, computer reservation systems, data transmission systems, and banking systems. The views expressed here are my own and do not necessarily reflect the views of the firms for whom I worked.

1. Of course, the appropriate resolution of the tension will vary from case to case and will be simpler in some cases than in others. For example, if product A is an input to product B and cooperation among firms is required to make A but not B, there is no reason to allow firms to cooperate in the making or selling of B, even if they are allowed to cooperate in the production of A.

2. An example illustrating this same tension in non-network industries between property rights in information and competition is _Berkey v. Kodak_ (603 F.2d 263), in which the court ruled that Kodak did not have a duty to predisclose its planned innovations so as to assist rivals.