Nicholas Economides is an associate professor of economics at Stern School of Business, New York University.

Commentary

Nicholas Economides

FEATURES OF CREDIT CARD NETWORKS

A first glance at credit card networks reveals a complex transaction and payment structure. A typical credit card transaction has four parties: the customer, the bank that issued the customer's card, the merchant, and the merchant's bank.[1] The four parties are complementary links in the transaction. The transaction begins when the customer (lower left corner of Figure 1) makes a $100 purchase from the merchant with a credit card. The merchant is paid less than the customer pays to the card-issuing bank. For example, the merchant may collect only $96 on the $100 purchase; the difference is called the discount. Thus there are at least two possibilities of collecting rent: first, by the card-issuing bank through the interchange fee and second, by the merchant bank, which collects the difference between the discount and the interchange fee.

Three out of the four parties of a typical transaction compete with other firms that sell substitute goods or services. Clearly merchants compete with other merchants for customers; merchant banks compete with other banks for merchants; and card-issuing banks compete for customers. To compete, firms may create brand names, differentiate their products, and add extra services to the basic service that they provide. Thus competition in credit card networks is complex. Nevertheless, credit card networks adhere to the basic principles of operation of all networks. To understand credit card networks better, we turn to a general analysis of competition in networks.

GENERAL FEATURES OF NETWORKS

A comprehensive analysis of the basic structure of networks and a survey of recent research on networks can be found in Economides and White (1993) and Economides (forthcoming), respectively. We borrow and summarize a number of those results here. A central feature of networks is that network goods or services exhibit network externalities: adding another customer adds value to the existing customers of the network. A consumer's willingness to pay for a network good or service increases with the level of expected network sales. In general, network externalities arise out of the complementarity between the various pieces of the network. A physical network is made of complementary components. For example, in Figure 2, a simple star telephone network, consumers are connected to a switch, S. A phone call between A and B (good ASB) comprises two complementary components, AS and SB. That is, customer A can use the telephone services only by talking to another network customer, and in consuming good ASB, both customers A and B simultaneously use the switching service, S.

The analysis extends to virtual networks. Virtual networks have complementary components, that is, components of vertically related products. Examples of virtual networks include the combination of computer software and hardware, and the collection of compatible computer central processing units and video monitors. The Visa credit card virtual network has a Visa issuing bank, a merchant bank, a merchant that accepts Visa cards, and a customer with a Visa card. An integrated system of automated teller machines (ATMs) is a network that includes banks that issue ATM cards, the system that provides ATMs and the data processing functions necessary for their operation, and the customers

1 Baxter (1983) and Carlton and Frankel (1995). Figure 1 taken from Carlton and Frankel (1995), p. 647.

who use their ATM cards. One may even think of buyers and sellers in a financial exchange, such as the NYSE, as constituting a virtual network.[2]

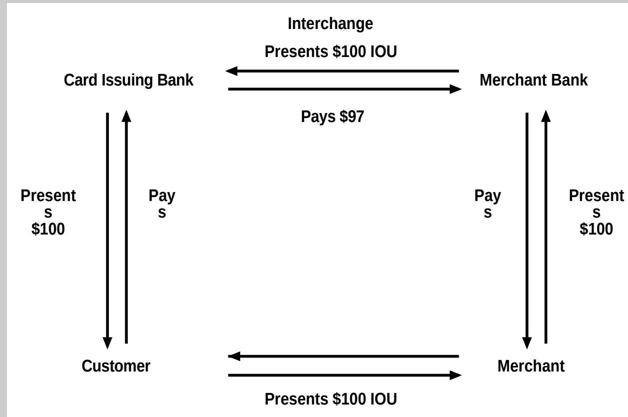
The network structure of Figure 3 can be interpreted as a long-distance network. One may imagine that customers Ai are in New York, while customers Bj are in San Francisco. Then a phone call from New York to San Francisco passes through the circuits of NYNEX (Ai SA), the lines of AT&T, MCI or Sprint in the long-distance part (SA SB), and the lines of Pacific Bell (SB Bj). A local phone call within New York is Ai SA Aj. Both Figures 2 and 3 depict two-way networks; transactions that have the same endpoints but go in opposite directions are distinct. For instance, a call from A1 to B1, which is charged to caller A1, is distinct from a call from B1 to A1.

The network structure of Figure 3 can also be interpreted as depicting an ATM network. Then Ai is an ATM and Bj is a bank. Customers of any bank Bj can use any ATM Ai. In this interpretation, the only transactions for which there is demand are the long-distance ones, for example, Ai SA SB Bj. There is no demand for any local transactions, such as Ai SA Aj and Bk SB Bl. In the ATM interpretation, this is a one-way network because there is no sense of direction.

The existence of network externalities implies that an extra sale has positive benefits to other buyers which the last buyer does not receive. It also implies that perfect competition is inefficient; it does not decentralize the optimal (social-welfare maximizing) allocation. To reach optimality requires two-part tariffs or other complicated nonlinear pricing schemes. Perfect competition fails because it doesn't internalize the externality. The much debated question of whether monopoly can do better is discussed in Economides and Himmelberg (1995), who conclude that monopoly cannot do better as long as no two-part tariffs are used. Thus there is no justification for monopoly on optimality grounds because of the network externalities.

Figure 1

Flow of Funds in Credit Card Transactions



Despite significant research, there is no comprehensive analysis of oligopoly in networks.[3] This is essentially because the network structure implies that competition in a network industry is both for individual components and for end-to-end service. Incompatibilities–for example, refusal to interconnect or refusal of access–limit the varieties of end-to-end service available to customers, as well as the extent of network externalities. The general flavor of current knowledge on the issue of compatibility is that a firm with a small market share desires compatibility more than a firm with a large share.[4] Thus incumbents may want to thwart entry through the creation of artificial incompatibities or through refusal of access.[5]

JOINT VENTURES

Joint ventures in network industries can have strong positive effects by setting compatibility standards and through coordination.[6] It is best if a joint venture is among firms that are only vertically related; end-to-end railroads, manufacturers of complementary components, and manufacturers and retailers are examples. If firms are also horizontally related, that is, they compete in some segments, there may be significant problems. For example, in an extreme case, a joint venture may be a

[2] See Economides (1993).

[3] See Economides (1996).

[4] Economides (1989, 1991).

[5] If incumbents have the possibility of collecting "interconnection fees" to give access to the network to an entrant, they may implement a price squeeze through high interconnection fees rather than refusing to deal or interconnect. See Economides and Woroch (1992).

[6] See Carlton and Klamer (1983), and Economides and White (1993).

Figure 2

A Simple Star Network

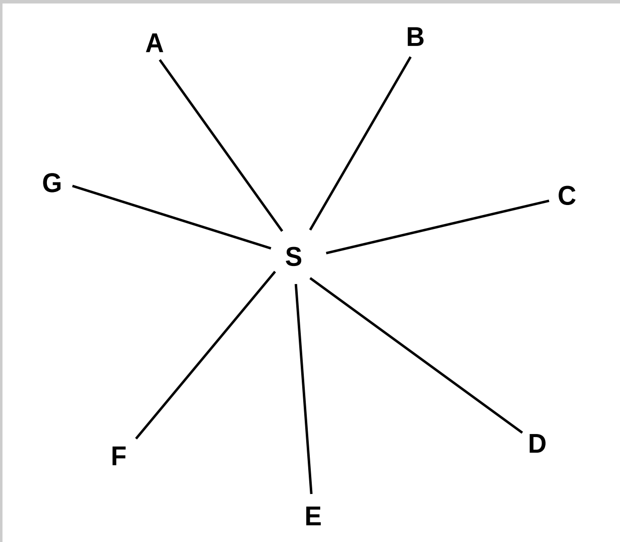
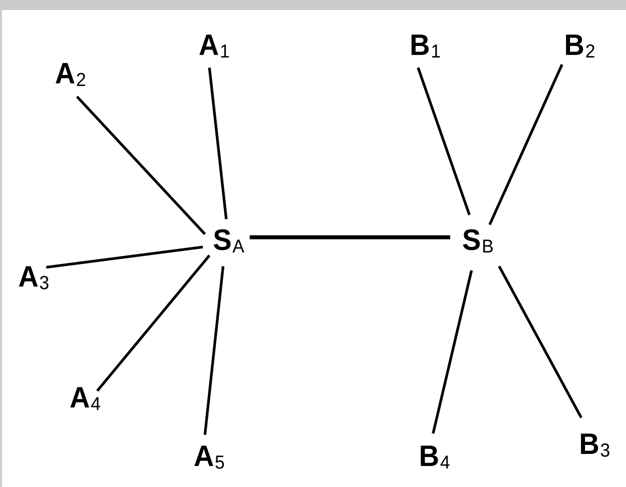


Figure 3

A Long Distance (or Automated Teller Machines) Network



vehicle for blatant horizontal price fixing or other forms of collusive pricing of the products of the joint venture.[7] Alternatively, a joint venture may be a vehicle for implicit coordination among competitors. Finally, a joint venture may be a vehicle to keep mavericks out of the industry. In that case, the refusal of access to the joint venture is similar to the refusal to interconnect in a network or a decision by a manufacturer to make the components of its product incompatible with components of other manufacturers.

ISSUES ARISING IN THE VISA DISPUTE

The credit card virtual network of Figure 1 is similar to the long-distance (or ATM) network of Figure 3, where $S_A A_i$ are the customers, $S_B B_j$ are the merchants, and the service $S_A S_B$ is provided by the participating banks. An important difference between a credit card network and a long-distance network is that today a long-distance network has full interoperability, that is, any call can go to any destination irrespective of the carrier. In contrast, credit card networks are incompatible. For example, a Visa transaction is only between a Visa cardholder, a Visa bank, and a Visa merchant.

Given that credit card networks are incompatible, entry is a crucial issue. Admission of new members should, in principle, intensify competition in the pricing of components that the members of the network provide, that is, intra-network competition. If members of the network (joint venture) cannot participate in a competing network, usually that should diminish competition among end-to-end services, that is, inter-network competition. In exceptional cases, this exclusion could promote competition. However, it is likely that the refusal to allow a member of, for example, the Discover Card network to issue a Visa Card and therefore have access to the Visa network, reduced inter-network competition.

Furthermore, in the Visa case, Discover wanted to enter with a long list of customers (as did AT&T earlier). Besides intensifying intra-network competition, the addition of a significant number of new customers would have created significant external benefits to all Visa banks, merchants, and customers because of the associated network externalities. Thus the

7 See *Financial Interchange.*

refusal of Visa to let Discover enter may have prevented the creation of significant additional social benefits.

REFERENCES

Baxter, William F. "Bank Interchange of Transactional Paper: Legal and Economic Perspectives," *Journal of Law and Economics* (No. 3 1983:26), pp. 541-88.

Carlton, Dennis W., and Alan S. Frankel. "The Antitrust Economics of Credit Card Networks," *Antitrust Law Journal* (Winter 1995), pp. 643-68.

Carlton, Dennis W., and Klamer, J. "The Need for Coordination Among Firms, with Special Reference to Network Industries," *University of Chicago Law Review* (1983:50), pp. 446-65.

Economides, Nicholas. "Desirability of Compatibility in the Absence of Network Externalities," *American Economic Review* (No. 5, 1989:79), pp. 1165-81.

_______. "Compatibility and the Creation of Shared Networks," in *Electronic Services Networks: A Business and Public Policy Challenge,* Margaret Guerin-Calvert and Steven Wildman, eds. Praeger Publishing Inc., 1991.

_______. "Network Economics with Application to Finance," *Financial Markets, Institutions & Instruments* (No. 5, 1993:2), pp. 89-97.

_______. "The Economics of Networks," plenary address, EARIE conference, September 1994, Discussion Paper no. EC-94-24, Stern School of Business, New York University, *International Journal of Industrial Organization* (No. 2, 1996:14).

_______ and Charles Himmelberg. "Critical Mass and Network Size with Application to the US FAX Market," Discussion Paper No. EC-95-11, Stern School of Business, New York University (1995).

_______ and Steven C. Salop. "Competition and Integration among Complements, and Network Market Structure," *Journal of Industrial Economics* (No. 1, 1992:40), pp. 105-23.

_______ and Lawrence J. White. "One-Way Networks, Two-Way Networks, Compatibility, and Antitrust," Discussion Paper EC-93-14, Stern School of Business, New York University (1993).

_______ and _______. "Access and Interconnection Pricing: How Efficient is the Efficient Components Pricing Rule?" Discussion Paper No. EC-95-04, Stern School of Business, New York University, *Antitrust Bulletin* (No. 3, 1995:XL), pp. 557-79.

_______ and Glenn Woroch. "Benefits and Pitfalls of Network Interconnection," Discussion Paper No. EC-92-31, Stern School of Business, New York University (1992).

First Tex. Sav. Ass'n v. Financial Interchange, Inc., 55 *Antitrust & Trade Reg. Rep.* (BNA) No. 1380, at 340 (Aug. 19, 1988) (Kauper, Arb.)