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Global ATM Banking: Casting the Net

by John D. Hueter and Ben R. Craig

Twenty-five years of technological progress have transformed the way banking is done. Paychecks can be deposited, charitable contributions withdrawn, electronically. Customers can make cash withdrawals without ever seeing a human teller, at a machine their bank doesn't own, perhaps even in a country where their bank has no office. These innovations have not only affected customer convenience, but have also changed the economic reference points for evaluating the efficiency of the electronic payments industry.

This *Economic Commentary* describes how a payment is automatically transferred through electronic signals, then discusses the automated teller machine (ATM) networks that cover the globe. Finally, it addresses the policy question of how to achieve a socially optimal system, emphasizing market structure, technology, and compatibility.

■ The Automated Clearing House

The Automated Clearing House (ACH) system makes payroll transfers electronically, using a network to move funds from the employer's account to the employee's (see figure 1).[1] In the case of a payroll transfer, the firm is the originator, arranging with its bank to transfer funds to its employee's account. The firm's bank assembles all the firm's transfers regardless of transaction type (payments for utilities or other services) and sends an electronic message containing a list of transfers to the ACH operator. The operator electronically sorts the transfers to their various banking destinations (not all payroll transfers go to the same bank) and calculates the total of credits (or dollar amounts) that need to be transferred. He or she sends an electronic message containing a list of the transfers to the various receiving banks, including the employee's bank or financial institution, which then credits the employee's account. The ACH operator is the key element in the process that clears and settles transactions between banks, eliminating the need for bilateral relationships between financial institutions. Like a billing agent, the operator informs the various banks that their accounts have credits or debits. In the case of the payroll transfer, the operator sends the firm's bank an electronic notice to debit the amount of the payroll and also the employee's bank of a credit. The transaction is usually settled with finality on the next day, when accounts are officially balanced with the proper funds.

In response to rapid increases in check volume in the 1960s and concerns about the cost of supporting future growth efficiently, the ACH payment mechanism was established in 1972 as an electronic alternative to the traditional paper-based check collection system.[2] One distinct advantage of ACH transactions over regular checks is cost. On the consumer end, there is no charge for paying your gas bill by the ACH system; with a check, there is the cost of the stamp, the check, and your time. From the corporate perspective, the cost of handling a check mailed by a consumer to the company's bank lock box is 14 cents (compared to 5 cents for an ACH payment).[3]

■ The ATM System

Once the payroll is deposited, an ATM system permits an employee to access the money at any time and from practically any place in the country (figure 2).[4] When a cardholder tries to withdraw money from an ATM machine, it sends a signal to a switch linked to the various financial institutions that issue ATM cards.[5] This switch connects the ATM machine electronically with the cardholder's bank, which automatically updates the cardholder's account and transmits its approval back through the switch to the ATM machine. Only then does the cardholder receive cash.

Both the ACH and ATM systems are examples of *networks,* where the benefits of one participant enhances the value of the structure for the other participants. Networks are difficult to analyze, but some recent results from economic theory suggest that competitive networks are preferable in a social sense to monopoly networks.

There are three types of ATM systems: proprietary, shared/regional, and national/international. A proprietary system, operated by a financial institution that purchases or leases ATMs, acquires the necessary software or develops it in-house, installs the system and markets it, and issues cards of its own design (proprietary systems are less prevalent today).[6]

A shared/regional ATM system is a network that comes into being when customers of one or more financial institutions have access to transaction services at ATMs owned or operated by other financial institutions. A common type of sharing is the joint venture with other financial institutions, featuring common access and cooperative control.

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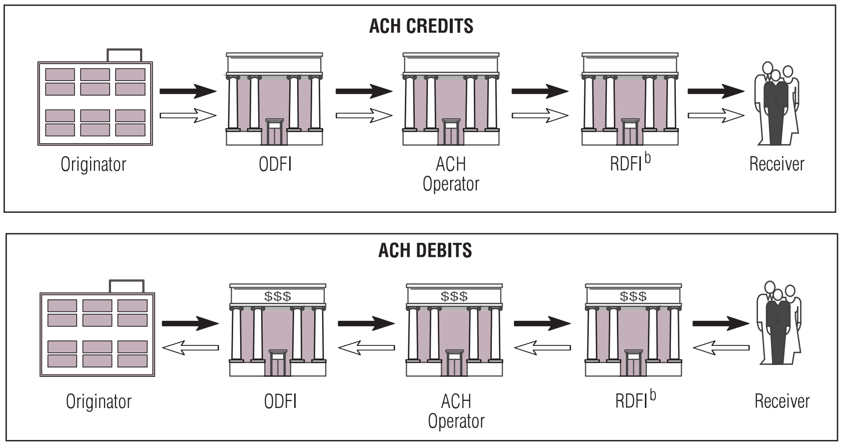
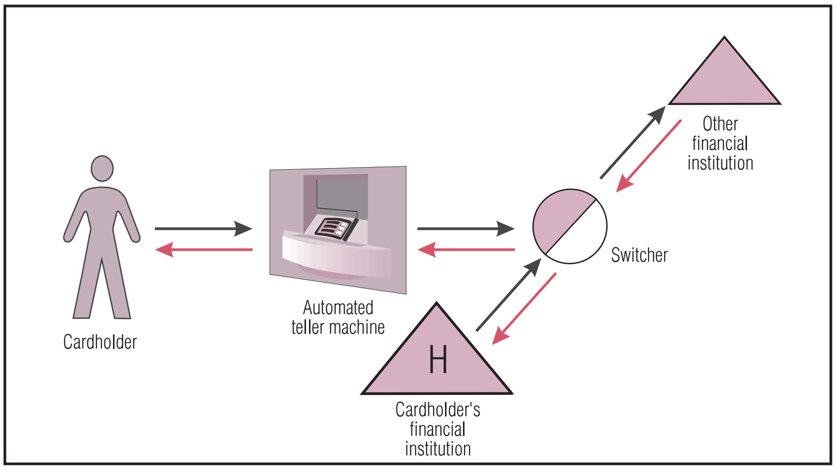
FIGURE 1 ACH TRANSACTION FLOWS



a. Originating depository financial institution.
b. Receiving depository financial institution.
NOTE: ➞ direction of transaction flow; ⇨ direction of funds flow.
SOURCE: Furash & Company.

FIGURE 2 ATM TRANSACTION FLOWS



SOURCE: Authors' adaptation of a chart from Star System, Inc.

A national/international system is also a network, one that enables an ATM machine in New York to connect with another in Los Angeles. Through service agreements with regional and proprietary networks, national networks link ATM machines coast to coast.

Networks

Although ACH and ATM systems are both networks, they are of two quite different sorts.[7] The ACH network connects two retail customers. For example, the government uses a bank's ACH services to send out Social Security checks, whose recipients, in turn, use ACH payments to cover electric bills or insurance payments. The ATM network connects two banks, giving customers access to a range of teller services.

Networks can be thought of as mechanisms through which economic agents (business firms, households, financial institutions) can interact with one another. An inherent feature of a network's structure is that it requires many components to provide a typical service.[8] More formally, networks are composed of links that connect nodes. Returning to figure 1, the nodes are the originator, the sending bank, the ACH operator, the receiving bank, and the final receiver, all linked electronically. Some other commonly used networks are long-distance phone services and the Internet.

A network's main characteristic is that its components are complementary: one needs the other in order to provide a service. Thus, a network is made up of complementary components that together produce a service or good. In the ACH example, the linkages from the employer's bank to the ACH operator and the ACH operator to the employee's bank are complementary. A single transaction is a good made up of two complementary links, the first between the employer's bank and ACH operator, the second between the ACH operator and the employee's bank. This complementarity leads to another feature: network goods and services exhibit *network externalities.* The benefit one person or institution gets from using a network depends on how many others are using it. For example, the value to a consumer from purchasing a VCR may depend on the number of rental movie titles available. The number of movie companies willing to publish titles in the same format in turn depends on the total number of people who own VCRs.

Network externalities are very different from some other common externalities such as pollution, where economic activity by some individuals produces pollutants that affect a broad population. Individuals make choices about participating in an activity that generates pollution, but have little choice about being affected by it. Network externalities are more self-contained. An individual's decision to subscribe to a network creates external benefits for other subscribers by increasing the size of the network. To enjoy the externality effects, however, one must join the network.

The benefits of the ATM network today are much greater than at its inception because it has grown so large. Access to ATMs and the convenience they offer cardholders are much greater now that there are more machines connected to more banks. Similarly, banks can substitute cheaper ATM transactions for more expensive human teller transactions because their customers are willing to use the machines, which are more convenient because more banks are placing machines on the network. The ACH system is a payments network. Users must be members of the network; the more members, the more valuable a membership.

Market Structure, Compatibility & Technology

Market structure, compatibility, and technology are three areas that challenge regulatory authorities to find ways to make a network socially optimal.

Market Structure

Competition alone does not ensure a socially optimal outcome for a network.[9] For one thing, joining up creates more benefits for existing members of the network than for the new member who pays the cost. Thus, the number of new members will be smaller than it would be had an all-knowing social planner mandated participation. Of course such an omniscient, disinterested planner exists only in our imaginations, so our concern should be whether the inefficiencies of the competitive price framework are large enough to justify using another structure.

For example, one might suggest a monopoly as a possible structure for achieving optimality, but recent studies strongly indicate that even though the monopolist has an interest in expanding the network to increase demand, this desire is overwhelmed by his natural tendency to raise prices by restricting output. Indeed, a monopolist-controlled network will be smaller than a competitive one. Therefore, the existence of network externalities does not reverse the standard welfare preference for a competitive market rather than a monopoly.[10]

We can say that a monopoly network is less efficient than a set of competitive ones, which in turn is smaller than optimal size, but much about networks remains undiscovered. How should we analyze the optimality of the current ATM system, with three national networks and five regional networks accounting for the majority of the transactions? How can the Federal Reserve price its 80 percent share in the ACH market efficiently? Network theory provides a framework for posing these questions precisely.

Technology and Compatibility

Network technology also raises difficult issues. There is no theoretical reason why one ATM network must be compatible with another. Indeed, rapid technical advances may provide strong incentives for new networks to use superior innovative protocols, file structures, encryption techniques, and so on, although they are incompatible with those of existing networks. These technical issues are further complicated by the difficulty of analyzing market structure.

To illustrate the sorts of problems a regulator faces, suppose an ATM network proposes developing a superior encryption technology that increases the security of transactions but is incompatible with other networks.

Developing new technologies is risky and expensive. Should the firm make the technology available to other networks, thus ensuring that the connected "meganetwork" (composed of the connected networks) is larger and giving its own members the positive network externalities? Or should the firm maintain exclusivity, thus conferring advantages of membership that are not available in other networks? Recent theoretical work has developed suggestive examples showing that, in some cases, meganetwork incentives are strong enough to encourage one network to share its technical secrets. In other examples, the monopoly incentives dominate and the network fights to retain exclusive control over its technology.[11]

Challenges

Policymakers face additional problems, especially when dynamic issues of market structure are considered. Some theoretical examples from the computer industry show that monopoly networks can be dynamically beneficial. If there are incentives for the innovating network to create new products (because they can extract rents later), allowing monopoly profits (even if that means short-term social inefficiency) can be beneficial over a longer horizon. Of course, as in all the approaches discussed here, the conclusions depend on the analyst's framework. Our empirical knowledge of the size of potential monopoly profits for ATM and ACH systems is so slight as to make judgments about the relevance of these assumptions very difficult.

Market structures are not static. Their dynamic properties depend on the compatibility of the technologies with other networks. For example, imagine a market with a large number of competitive, identical networks whose technologies are mutually incompatible. While this situation is possible, it is dynamically unstable. If even one additional individual joins one of these networks, that network becomes more useful to its members because it is larger. This induces more members to switch to the bigger network, and the cycle continues, until the market consists of only one monopoly network. This simple example illustrates the difficulty of evaluating a policy solely from the perspective of current market structure. A given antitrust policy for the ACH network could produce undetermined effects if the market structure changes. Suppose, for example, that, socially speaking, the best solution calls for a high price in Fed ACH services in a hypothetical static scenario. The social effects could be disastrous if it were to encourage monopoly transformation of the electronic payments industry.

Thus, ATM and payments networks are nonstandard industries because of their strong network externalities. Initial research on the ACH system suggests that it involves large-scale network externalities.[12] While it is clear that we need more theory about how networks operate, along with research that distinguishes the most relevant models, the current state of network theory provides basic intuition about appropriate policy as well as a precise framework in which to formulate the policy discussion.

Footnotes

1. The ACH is an electronic batch processing system by which payment orders are exchanged among financial institutions. It is designed for high-volume, mostly small-dollar recurring transactions, such as payroll, mortgage, car loan, or Social Security payments. For complete definitions and a diagram of the ACH process, see U.S. General Accounting Office, *Payments, Clearance, and Settlement: A Guide to the Systems, Risks, and Issues,* Report to the Chairman of the Committee on Banking and Financial Services, U.S. House of Representatives (GAO/GGD 97–73), June 1997.

2. There are four major ACH networks; the Federal Reserve System, the New York Clearing House Association, Visa, and the American Automated Clearing House Association. The Federal Reserve System is the largest, with over 80 percent of ACH volume.

3. American Electric Power presentation at the Payments 98 Conference, sponsored by the National ACH Association. Seattle, Washington, March 1998.

4. There were over 165,000 ATM terminals and over 10 billion ATM transactions in 1997. The three largest national ATM networks are Discover Card, Cirrus, and Visa/Plus, each with an average of more than 130,000 machines accessible through a single card. The leading regional networks are Star, Honor, NYCE, MAC, and Pulse, averaging over 20,000 machines each. See Faulkner and Grey, *Bank Network News,* vol. 16, no. 9 (September 26, 1997).

5. A switch is the mechanism that directs the ATM transaction to the cardholder's financial institution.

6. For descriptions of ATM networks, see Allen H. Lipis, Thomas R. Marschall, and Jan H. Linker, *Electronic Banking.* New York: John Wiley and Sons, 1985.

7. "ATM networks" refers to the shared/regional and the national/international ATM systems.

8. For good literature surveys on the economies of networks, see Nicholas Economides, "The Economics of Networks," *International Journal of Industrial Organization,* vol. 14, no. 6 (October 1996), pp. 673–99; and John A. Weinberg, "Network Externalities and Public Goods in Payment Systems," Federal Reserve Bank of Richmond, *Economic Quarterly,* vol. 83, no. 2 (Spring 1997), pp. 25–44.

9. We use "socially optimal" in the standard sense: No other outcome will make some participants better off without making any worse off.

10. See Nicholas Economides and C. Himmelberg, "Critical Mass and Network Size with Application to the US Fax Market," in Gerald W Brock, ed., *Toward a Competitive Telecommunication Industry: Selected Papers from the 1994 Telecommunications Policy Research Conference.* Mahwah, N.J.: Lawrence Eribaum Associates, 1995, pp. 47–63.

11. See Nicholas Economides, "A Monopolist's Incentive to Invite Competitors to Enter in Telecommunications Services," in Gerard Pogorel, ed., *Global Telecommunications Strategies and Technological Changes.* Amsterdam: Elsevier, 1994, pp. 227–39; and Nicholas Economides, "Network Externalities, Complementarities, and Invitations to Enter," *European Journal of Political Economy,* vol. 12, no. 2 (September 1996), pp. 211–33.

12. See Gautam Gowrisankaran and Joanna Stavins, "Are There Network Externalities in Electronic Payments?" Federal Reserve Bank of Boston, working paper (forthcoming).

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