Federal Reserve Bank of Cleveland

Network Externalities: The Catch-22 of Retail Payments Innovations

by William P. Osterberg and James B. Thomson

There are no technical barriers to the spread of electronic funds transfer. It parallels all the work done by the check system, and does it better, more cheaply, faster, and at greater convenience to all users of the payments system.[1]

George W. Mitchell, November 26, 1973

After years of being carefully planned, tended and nurtured in the back rooms of the nation's financial community, electronic banking finally seems ready to blossom into reality.[2]

U.S. News and World Report, August 5, 1974

Get Ready for Cashless, Checkless Living: For Many People It's Already Here, Lots of Advantages – But It's Scary, Too.[3]

Changing Times, October 1975

For more than two decades, economists and business journalists have heralded the coming of a paperless society in which electronic payments will quickly replace the use of cash and paper checks in retail transactions. However, although tremendous advances in computing and telecommunications have facilitated development of inexpensive, safe, electronic retail payments, neither the number nor the dollar volume of paper-based transactions has dropped appreciably (see figure 1). Moreover, only modest declines in the growth rate of paper payments are predicted in the near term.

There are several reasons why the adoption of electronic payments instruments has begun slowly. First, consumers seem to have strong preferences for paper payments vehicles, partly because they are familiar. Second, while paper-based transactions may be more expensive on average than electronic ones, the marginal cost to the consumer of making an additional payment by check or cash is typically very small. Third, doubts as to the applicability of existing laws and regulations increase the perceived risk of using electronic instruments. Finally, there are significant external benefits, arising from network economies, associated with these instruments.[4] For instance, the value to the consumer of any payments vehicle depends on its acceptability (that is, on the number of establishments where it can be used). Likewise, an establishment's willingness to accept a method of payment ultimately depends on projected consumer use.

While each of these impediments merits investigation and discussion, this *Economic Commentary* will focus on the role of network externalities. For ease of exposition, it will center on a single type of electronic retail payments instrument —the stored-value card.

Network Externalities

Network externalities arise when the benefit a consumer expects to receive from a good or service depends on the number of consumers using the good. The fax machine is a classic example: If only one business owned a fax, the machine would have no practical value. The existence of a second machine would increase the benefits to the first machine's owner by activating the potential for sending and receiving faxes. Each additional fax installation in a different location would increase benefits to existing users; conversely, the benefits to the new purchaser would depend on the number of machines already installed.

Why aren't more consumers replacing cash and checks with electronic innovations like stored-value cards? This *Economic Commentary* focuses on one of the reasons: A consumer's benefits from having a card depend on how many businesses will take it in payment. However, merchants will refuse to invest in the systems needed to accept the cards until they are sure there will be enough consumer demand to justify the expense. This interdependency of demand will remain an obstacle until the innovation achieves critical mass, either in its own time or with policymakers' help.

This interdependency of demand means that the market for a network good must reach a minimum size before a sustainable equilibrium can be achieved. Economists Nicholas Economides and Charles Himmelberg call this minimum size the network's "critical mass."[5] The concept is important because market dynamics can change considerably once critical mass has been achieved. Markets for network goods may grow slowly until reaching a critical mass, then suddenly begin expanding quite rapidly. This makes it difficult to forecast the size of a market (or the economic importance of a good) on the basis of growth rates before critical mass has been attained.

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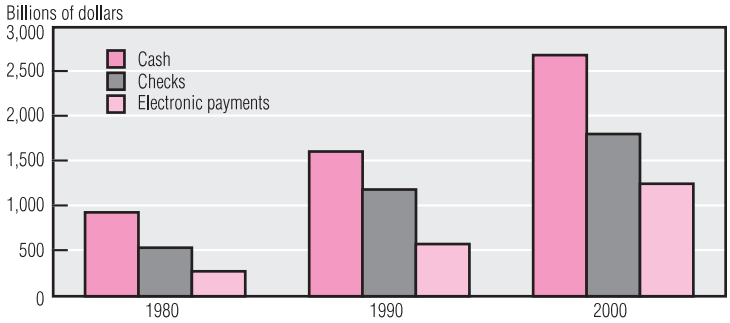
FIGURE 1 PAYMENT TRENDS



SOURCES: American Bankers Association, *Statistical Information on the Financial Services Industry*, 7th ed., Washington, D.C.: ABA, 1996; and Furash & Company estimates.

Credit cards provide a useful illustration of how growth dynamics in the market for a network good can change over time, with the good's value to consumers depending on the size of the network. For example, figure 2 shows that the market for Visa cards grew relatively slowly in the early 1970s and exploded in the late 1980s and early 1990s. Had projections of the number of Visa cards been based on the market's 1970–76 level and growth rate, they would have seriously understated the market's 1996 size.

Network Characteristics of Stored-Value Cards

Stored-value cards are a payments innovation designed to substitute for cash transactions. The cards carry transferable cash-equivalent balances that can be reloaded at specially fitted ATM machines and—in the future—at home through devices attached to personal computers. The balances they carry are equivalent to cash because they can be transferred in a retail transaction without the direct involvement of a financial intermediary.[6] Credit card, debit card, and check transactions, on the other hand, represent instructions for the consumer's bank to pay the merchant (or the merchant's bank on the merchant's behalf). A depository institution's direct involvement in credit cards, debit cards, and checks increases the fixed costs associated with using these instruments, making them impractical for small dollar transactions. Because its balance is transferred directly from the consumer to the merchant, the stored-value card could replace a range of cash transactions.[7]

Stored-value cards are said to exhibit network externalities because the average consumer's benefit from using them in transactions depends on how many other consumers and businesses are using the same vehicle. In addition, the total benefits associated with the use of stored-value cards exceed the benefits accruing directly to an individual consumer. By extending the network, one person's participation also increases the benefits to others.

However, a *Catch-22* dilemma arises from the introduction of a new payments instrument:[8] Business and consumer demand for stored-value cards are interdependent. In our earlier example, the benefits to a fax machine owner may come from the ability to send messages or to receive them. The network economics do not change whether the machine's value derives from one or both of these functions. That is, the benefits this person or business expects to derive from ownership depend on the number of machines installed, and the total benefits of an additional machine exceed the benefits accruing directly to its owner.

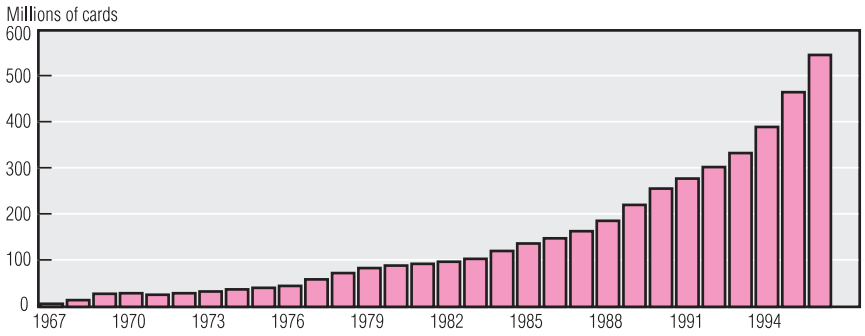
In the case of stored-value cards, there are two types of benefits—those accruing to the payor in a transaction and those accruing to the payee. However, as figure 3 shows, in the market structure foreseen for most stored-value cards, the payor and the payee are almost never the same entity. Unlike the owner of a fax machine, who can both send and receive faxes (that is, switch sides of the market or transaction), payors cannot receive payments, nor can payees initiate them. In other words, a participant is always on only one side of the market. Hence, the nature of the demand interdependency is determined by the total number of market participants and by the relative numbers of payors and payees.

Why does the demand for stored-value cards depend on both the total and the payor/payee balance? The explanation is this: The benefit to the consumer (payor) of having a stored-value card is a function of how many establishments will accept it in payment for goods and services. Merchants (payees), on the other hand, are likely to invest in the systems necessary to accept stored-value cards only when there is a sufficiently large demand for using this payments instrument. Therefore, the benefit a consumer expects to derive depends directly on the number of establishments accepting stored-value cards and only indirectly on the number of consumers using them. A merchant's benefit, conversely, depends directly on the number of consumers using stored-value cards and only indirectly on the number of establishments accepting them. Herein lies the *Catch-22* quality of the demand interdependency for these cards.[9]

Critical mass in the stored-value-card market will be reached when the demand interdependency between payor and payee is no longer economically significant. This will occur when the benefits a consumer or merchant expects to receive from adopting this payments innovation are not significantly affected by an increase in the network's size. Put more simply, critical mass will be achieved when the consumer's expected benefit from having a stored-value card will not be materially affected by a small increase in the number of consumers using it.

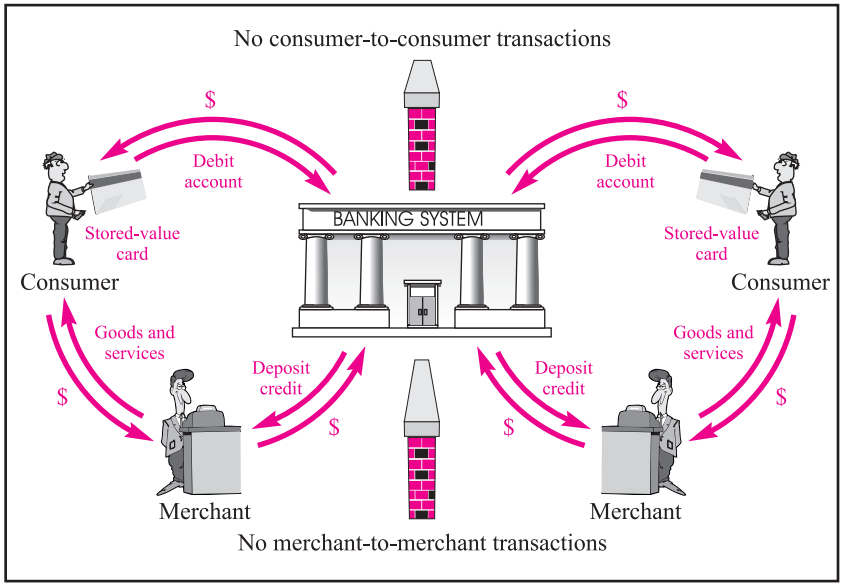
However, until critical mass is achieved, the demand interdependency between payor and payee increases uncertainty about the viability and future value of stored-value cards, causing consumers and merchants to discount them and thus reducing their perceived value. Because there are fixed costs to payors and payees associated with adopting a new instrument, this increased uncertainty may slow the stored-value card's initial rate of adoption and market growth, thereby impeding its expansion toward a critical mass. After all, a merchant's decision to accept the stored-value card depends on whether the discounted expected future returns from the card exceed the fixed costs of installing the hardware and software required to accept it.

FIGURE 2 WORLDWIDE MARKET FOR VISA CARDS



SOURCE: VISA International, card program annual data (excludes Interlink).

FIGURE 3 STRUCTURE OF THE STORED-VALUE-CARD MARKET



SOURCE: Authors.

Policy Considerations

Network externalities are a form of market failure that may result in underprovision of a good or service by the market and the consequent reduction in the total welfare of society. In the case of retail payments innovations, policymakers and elected representatives must determine whether the market failure is economically significant and thus a problem requiring government intervention.[10]

The case for government intervention in these markets has not yet been established. Hence, current policy toward retail payments innovations such as stored-value cards seems to reject the need for active government involvement in these markets, at least for now.[11] This stance is partly a reflection of policymakers' concern that government intervention could distort the market for electronic payments innovations. Federal Reserve Board Chairman Alan Greenspan expressed these sentiments in a speech on electronic money: "If we wish to foster financial innovation, we must be careful not to impose rules that inhibit it. I am especially concerned that we not attempt to impede unduly our newest innovation, electronic money, or more generally, our increasingly broad electronic payments system. . . . To develop new forms of payment, the private sector will need the flexibility to experiment, without broad interference by the government."[12]

Consequently, past government action has been limited to technical changes in the U.S. Code and interpretations of the applicability of existing laws and regulations to stored-value cards.[13] Policymakers have focused their energies on removing barriers to the cards' growth, while letting the market resolve the associated technical and economic issues.[14]

Today's benevolent wait-and-see policy is thought to have a relatively low risk because the market for electronic retail payments innovations is fairly small now and is projected to grow slowly. In other words, policymakers feel they have ample time to impose regulations after the fact if market developments warrant a reaction. This approach may make sense in the early stages of market development; however, it is important to recognize that once the market attains a critical mass, growth rates may accelerate dramatically. The speed of this change will narrow the window of opportunity for curtailing negative market developments, should they arise. Hence, failure to understand the market dynamics for goods exhibiting network externalities increases the riskiness of a wait-and-see policy.[15] This makes it important that policymakers address the nature and severity of externalities in formulating policy toward retail payments innovations.

Footnotes

1. Statement by George W. Mitchell, Vice Chairman, Board of Governors of the Federal Reserve System, before the Subcommittee on Bank Supervision and Insurance of the Committee on Banking and Currency, U.S. House of Representatives, November 26, 1973.

2. *U.S. News and World Report*, "'Electronic Money'—What It Is and the Changes It Will Bring," August 5, 1974, pp. 50–52.

3. *Changing Times: The Kiplinger Magazine*, October 1975, pp. 6–8.

4. For a literature review, see Nicholas Economides, "The Economics of Networks," *International Journal of Industrial Organization*, vol. 14, no. 6 (October 1996), pp. 673–99.

5. See Nicholas Economides and Charles Himmelberg, "Critical Mass and Network Size with Application to the US Fax Market," New York University, Working Paper No. EC–95–11, August 1995.

6. In at least one system, Mondex, individuals can transfer balances among themselves. See Gerald Stuber, "The Electronic Purse: An Overview of Recent Developments and Policy Issues," Bank of Canada, Working Paper No. 74, January 1996.

7. By one estimate, stored-value cards will capture five to 10 million users by 2000. See McKinsey & Company, "From Atoms to Bits: Managing an Industry in Transition," *Proceedings of the National Payments System Symposium*, Washington, D.C., October 8, 1996.

8. See Joseph Heller, *Catch-22*, New York: Simon and Schuster, 1961.

9. The market for VCRs exhibits a similar network externality. The demand for Beta relative to VHS machines is a function of the number of video titles available in each format, and the number of video titles produced for each format depends on the number of each type of machine sold.

10. Establishing whether government intervention is warranted requires a complicated cost–benefit analysis comparing the direct and indirect costs of the intervention with the expected benefits.

11. For an extensive review of the policy issues associated with stored-value cards, see Gerald Stuber, "The Electronic Purse" (footnote 6); and Alan S. Blinder, "Fed Views on Electronic Retail Payments Technologies," *Payments Systems Worldwide*, Winter 1995–96, pp. 12–15.

12. See Alan Greenspan, "Remarks at the U.S. Treasury Conference on Electronic Money and Banking: The Role of Government," Washington, D.C., September 19, 1996 (*www.bog.frb.fed.us/boardocs/speeches/19960919.htm*).

13. See Jeff Lacker, "Stored Value Cards: Costly Private Substitutes for Government Currency," Federal Reserve Bank of Richmond, *Economic Quarterly*, vol. 82 (Summer 1996), pp. 1–25, footnote 18; Federal Deposit Insurance Corporation, "General Counsel's Opinion No. 8; Stored Value Cards," *Federal Register*, vol. 61, no. 150 (August 2, 1996), pp. 40489–94; and Board of Governors of the Federal Reserve System, *Report to the Congress on the Application of the Electronic Fund Transfer Act to Electronic Stored-Value Products*, March 1997.

14. For a discussion of some of the technical issues that need to be resolved, see Barbara A. Good, "Electronic Money," Federal Reserve Bank of Cleveland, Working Paper No. 9716, December 1997.

15. If problems that are large enough to raise policy concerns fail to surface until the market is near or at its critical mass, the risks of a wait-and-see regulatory policy may outweigh the benefits.

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