1 THE ROLE OF INTERSTATE BANKING IN THE DIFFUSION OF ELECTRONIC PAYMENTS TECHNOLOGY

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INTRODUCTION AND CONCLUSIONS

The most important technological change in payment methods has been the development of electronic alternatives to paper-based cash, check, and credit card systems. During the 1960s and 1970s the firms involved in this development and the popular press projected a near-term cashless and checkless society as a result of this technological change in payments means. However, it is now clear that the electronics revolution is not arriving on time. Electronic payments transaction volume constituted less than one-half of 1 percent of all payments made in 1983.

The problem is that although technological change makes certain things possible—such as the substitution of ACH (automated clearing house), ATM (automated teller machine), transfers, and wire transfer electronic payment means for cash, checks, and credit cards—institutional factors and their resulting economic impacts effectively block implementation of such a substitution on a large scale. In addition to technological feasibility, two necessary conditions for electronic payments diffusion are currently not met. First, it is necessary for users,

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particularly the lay public, to become familiar and comfortable with electronic payment methods and perceive them as safe. Second, the effective user costs of electronic payments must be close to or lower than the user costs of nonelectronic alternatives, which is not currently the case. On average, checks have lower user costs—in fact, these costs are negative—because of the float benefits attached to check use but not to electronic payments. The current high cost-low usage situation for electronic alternatives appears to be a sustainable equilibrium because (1) as long as user costs of electronic payments remain high, the public will not become familiar with these alternatives and use them regularly, and (2) the possibility of exploiting cost-reducing scale economies in the production of electronic payments will be foiled as long as usage is low.

This chapter demonstrates how long-standing institutional factors have essentially neutralized the diffusion of electronic payments practices. These factors include:

1. the existing framework of legal rights and liabilities governing the payments system;
2. the "market failure" involved in the use of checks and credit cards due to the externalities of float transfer payments;
3. the established retail practice of not differentiating purchase price by payment means;
4. the difficulty of negotiation among large numbers of agents with regard to the distribution of benefits from adopting new payment techniques;
5. the practice of banks to not charge through direct fees the full cost of handling payment instruments; and
6. the reluctance of users to alter set payment behavior patterns and the distribution of float benefits.

We also demonstrate that without a change in the structure of the banking industry, the electronic payments revolution is likely to continue to languish. Any future decreases in the costs of electronic payments are unlikely to offset substantially the huge competitive advantage that checks and credit cards hold because of float benefits. In addition, the institutional changes that may occur on the retail level—price differentiation by payment method, more widespread availability of point-of-sale electronic payment systems, and more and higher per-transaction fees on checks and credit cards—are un-

likely to bring about the electronic payments revolution without the additional impetus of a more concentrated national banking industry.

This chapter posits an alternative scenario that may drive the future development and use of electronic payments. This scenario involves an important institutional change—interstate banking—which will take place for reasons exogenous to the payments system. Our premise, supported by the results of our forthcoming empirical study (Berger, Humphrey, and Frodin), is that interstate banking can profoundly improve the efficiency of the check-clearing system, with important spillover effects onto electronic funds transfers. Interstate banking will increase the proportion of "on-us" checks, those requiring no external processing and creating no interbank float. It will also dramatically reduce the number of handlings required for transit check items—checks that are now sent between some 15,000 different banks. Bank consolidation will concentrate check handlings into fewer and larger correspondent banks, fewer items being processed by the Federal Reserve. These changes alone will encourage the diffusion of electronic payments somewhat, as the float benefits of check usage decrease and the costs of electronic payments processing falls since larger payment volumes could be sent to fewer presentment endpoints.

In addition, a smaller number of larger correspondent banks will, because of cost economies, encourage check truncation, which is a "back office" method of "electronifying" paper check transactions. Users may continue to write checks, but their processing and collection will be electronic through an ACH network. This aspect of increased ACH use will also reduce costs for nontruncation ACH users, as scale and scope economies are exploited. A further possibility is that a more concentrated banking industry will assist in bringing about institutional changes on the retail payments level.

SUBSTITUTABILITY AMONG PAYMENTS MEANS

In this section we briefly describe the major payments instruments and show their uses. We also outline the possibilities for substitution between electronic and nonelectronic payments methods and illustrate the primary variables affecting the relative demand and supply functions for payment instruments.

Table 1-1. Description of Payment Methods.

Cash—May be obtained from a bank teller, automated teller machine (ATM)*, or cash dispenser (CD)*. Has a float cost to the user.

Checks—Provisional funds that have float benefits to the user—mail float plus interbank processing and transportation float. May be processed as an on-us item, through a direct exchange, correspondent bank, the Federal Reserve, or be truncated, where the interbank funds are sent by ACH*. This last method of check collection should be distinguished from check safekeeping or truncation at the bank of last deposit, where the collection of funds is conventional but the bank saves handling and postage costs by not returning the physical items to the payor.

Money Orders and Traveler's Checks—Purchased from merchants or financial institutions using only good funds. Substitutes for checks when provisional funds are not acceptable. Processed and issued by bank holding companies and service companies. Has a float cost to the user.

Credit Cards—Provide provisional funds, verifiable for large transactions, and creates processing and billing float. May be processed entirely through service companies (e.g., American Express) or in conjunction with banks (e.g., Visa). May be collected by monthly check payment or automatic ACH debit to bank account via prior agreement*.

*Automated Clearing House (ACH)**—Allows a party to initiate a debit or credit with another party automatically with one or two days notice to the bank and a signed agreement between the parties. Trailing descriptive data accompany the funds transfer. Usually used for direct deposit of payroll or U.S. government income payments (about 60 percent of current use), or other regular payments like insurance premiums. Most of the processing is done by the Federal Reserve. The Corporate Trade Payments (CTP) pilot program is an experiment in which participating corporations initiate the transfers, which include more detailed trailing information. Banks and the Federal Reserve collaborate on processing and settlement for CTP.

*Wire Transfers**—Can be used to transmit same-day good funds to any other party in the United States almost immediately. Can be processed through Fedwire (Federal Reserve System) or CHIPS, CHESS, or CashWire (international, regional, and national private sector systems).

Point-of-Sale (POS) with Debit Card or Smart Card*—Provide nonprovisional payment in which the customer's account is debited immediately and transfer made to the merchant's account, or the funds may be already withdrawn and embedded in the card (smart card). May be operated by one or more banks in conjunction with one or more merchants and perhaps a service agency.

Automated Teller Machine (ATM) or Cash Dispenser (CD)**—CDs may be used only to withdraw cash from an account. ATMs may be used to deposit or withdraw cash, determine balances, transfer funds among an individual's accounts,

Table 1-1. continued

or make regular bill payments for items such as loans, credit cards, utilities, and so on. Bill payments may be transfers between accounts of different customers at the same bank or may be processed as ACH* items for transfers between banks.
Telephone Transfer, Home Banking**—Can be used for any of the ATM functions above, except cash disbursement.

Note: An asterisk denotes an electronic-payment method.

Description of Payments Means

Table 1-1 briefly describes each payments means and how the underlying processing might be performed and indicates with an asterisk (*) when electronics are used. Note that virtually all transactions other than cash become electronic once they reach the bank of last deposit.

The only nonelectronic payment form that can be made electronically without the user's active participation is check truncation with interbank funds collection by ACH. Even this form requires some type of user participation since check writers will not receive their canceled checks. Currently, truncation is practically nonexistent, except for credit union share drafts, which originally had to be truncated by law.

The Use of Different Payment Means and the Range of Substitutability

The current use of the major payments methods is shown in Table 1-2. These data apply to all types of users, both individual and business. In terms of volume, nonelectronic payments constitute more than 99 percent of all transactions. In terms of dollar value, however, electronic payments account for 78 percent of the total dollars transacted.

The differences in average dollar size across payments methods limits the range of potential future substitutability between nonelectronic and electronic payments means. For small dollar payments, cash currently predominates. Point of Sale (POS) has a possibility to

Table 1-2. Volume, Value, and Growth of Different Payment Instruments, 1983.

Type of Payment Instrument	*Volume (millions)*	*Total Value ($ trillions)*	*Average Dollar Value*	*Annual Growth (1981–1983)*	*Percentage Volume Composition*
	(1)	(2)	(3)	(4)	(5)
Nonelectronic					
Cash	112,000	2.8	25	9%	70.41%
Checks	40,000	36.0	910	6	25.14
Credit cards[a]	4,980	0.208	42	11	3.13
Money orders[b]	750	0.050	67	0	.47
Traveler's checks[c]	800	0.028	35	7	.50
					99.65%
Electronic					
ACH	400	0.7	1800	27%	.25%
ATM transfers[d]	75	0.005	70	4	.05
POS[e]	19	0.0006	30	100 (?)	.01
Wire transfers	57	142.0	2,500,000	11	.04
					.35%

a. Data on credit cards covers retail (59%), bank (18%), oil company (18%), and all other company (5%) issued cards for 1982. Dividing total value ($208 billion) by the total number of transactions (4.98 billion) gave an average value per transaction of $42 in 1982 (*The Nilson Report* 1983: 4–5). Transaction volume growth was 11 percent annually over 1981–83 (for bank cards only, *The Nilson Report* 1984: 5). The credit card data shown in BIS, 1985, table C, p. 89, was developed from the same source (although the transaction volume figure shown was misprinted).

b. Accurate data on money orders exist only for those issued by the U.S. postal service. Penzer (1978: 26) estimated that postal money orders constituted between 15 percent and 21 percent of the value of all money orders issued by bank holding companies, private firms, and the U.S. postal service in 1976. Thus, the average "market share" of postal money orders was 18 percent. We assume that this market share can be applied to the value ($9.085 billion) and volume (135 million) of postal money orders processed in 1984 (Board of Governors of the Federal Reserve System, *Annual Report*, 1984: 238). Under this assumption, the value of all money orders in 1984 is estimated to be $50 billion, with 750 million being issued. The average dollar value per postal money order was $67. Annual growth of postal money orders

c. Data on traveler's checks refer only to those issued by nonbank firms like American Express. The average number of days a traveler's check is outstanding at American Express in 1983 was sixty-four days, from [(average daily value of outstanding traveler's checks $2.437 billion)/(total sales of traveler's checks in 1983 $13.862 billion)] 365 = 64, as reported in their *Annual Report.* Assuming the figure applies as well to all nonbank traveler's checks issued, the total value of nonbank traveler's checks is estimated to be $27.9 billion (from (365 days/64 days) times $4.9 billion in average daily value of outstanding nonbank traveler's checks reported in the money supply statistics in the *Federal Reserve Bulletin*, table 1.21, p. A13 for December 1983). Since actual data are proprietary, we assume that $50 and $20 traveler's checks were issued in equal proportions (and neglected the $100 and $10 face value checks) giving an average face value per traveler's check of $35. Transactions volume was thus estimated as 800 million (from $27.9 billion/$35 = 797 million). This is very approximate since some transactions require more than one traveler's check while for others one is too much and cash is received back as change. Annual growth was computed from data on the value of outstanding traveler's checks reported in the *Federal Reserve Bulletin* referenced above. This estimation procedure effectively implies that American Express has a market share of 50 percent (from $2.437 million in outstanding American Express traveler's checks divided by the $4.9 billion figure used in the money supply statistics) and is almost identical to the 50.5 percent market share estimate for 1976 in Penzer (1978: 23).

d. Refers only to bill payment transactions (excludes cash withdrawal, balance inquiry, and balance transfer transactions). Zimmer (1985) estimates that in 1983 there were 3.75 billion ATM financial transactions—withdrawals plus deposits, excluding account transfers. ATM bill payments were around 2 percent of this total, or 75 million (Cox and Metzker 1983: chart 6). Total ATM withdrawal volume alone is estimated to be 2.8 billion (for bill payments, cash withdrawals, and account transfers). We concentrate on the bill payment aspect of ATM usage because we are interested in the payment method used for the *final* transaction. Two ATM cash withdrawals may replace one check written for cash—a standard industry assumption, but cash is still used in the final transaction. Put differently, we focus on ATM use in place of checks when checks have float. A check written to obtain cash will typically impose a float *cost* on the check user, rather than have a float benefit (unless all the cash is spent within one day). The average dollar value per ATM transaction for 1983 of $70 was estimated from 1984 data: $90 billion in ATM withdrawals plus $182 billion in ATM deposits divided by 3.91 billion in ATM financial transactions. Annual ATM transaction growth of 4 percent was from reported growth in ATM financial transactions over 1983 (3.75 billion transactions) to 1984 (3.91 billion transactions). This low reported growth reflects the industry consensus that, after very rapid ATM growth a few years back, a "wall" of consumer acceptance has been reached with around a 33 percent penetration of the potential market. All ATM data used in this table are from Zimmer (1985). Total ATM bill payment transaction value of $5.3 billion is from 75 million bill payment transactions times an average value per transaction of $70 (which includes more than just bill payments).

e. Transaction volume at a sample of 62 Mobil Oil stations in 1984 was 10,000 per month (*POS News* 1985: 6) or 1,935 annually per terminal (from 10,000(12)/62). This is much lower than the average of 5,500 financial transactions (excluding balance inquiry) per ATM terminal noted by Zimmer (1985). Total POS transaction volume is estimated to be 19 million, assuming that the Mobil Oil transaction volume per terminal is representative of transactions on all 10,000 POS terminals in place in 1984 (BIS 1985: 90, table D). Oil company terminals constitute around 20 percent of all POS terminals. In addition to terminals at gas stations, there are terminals at convenience stores and supermarkets (20%), and other retail outlets (60%)—*POS News* 1985: 1. The average dollar value per POS transaction (*POS News* 1985: 2–7) is $14 at gas stations, $8 at convenience stores, and perhaps $42 at other retail outlets, giving a weighed average of $30 (from $14(.2) + $8(.2) + $42(.6) = $30). The total value of POS transactions is thus $30 times 19 million = $570 million. Annual growth is likely to be exponential; we simply assume 100 percent.

Source: Humphrey (1984: 6) for all data on cash, checks, ACH, and wire transfers. Other data sources are noted in the lettered notes.

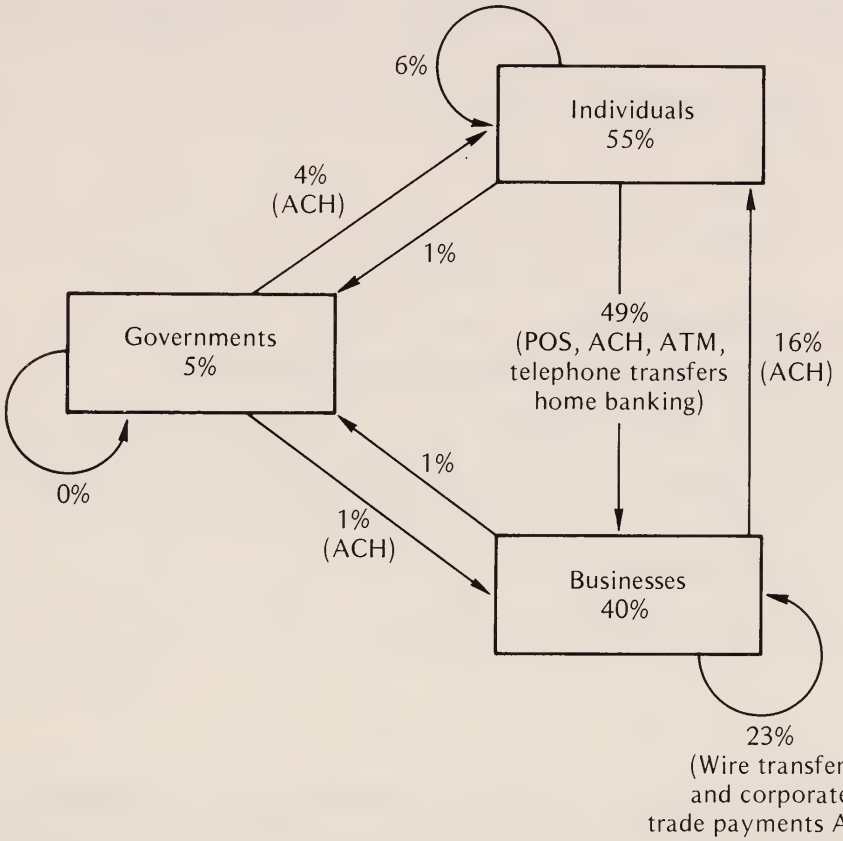
Table 1-3. Substitutions between Nonelectronic and Electronic Payments.

Value of the Transaction	*Nonelectronic Payment Method*	*Electronic Payment Method*
Low dollar	Cash	POS
Medium dollar	Checks, credit cards, money orders, traveler's checks	POS, ACH, ATM, telephone transfer, home banking
High dollar	—	Wire transfers, Corporate Trade Payments ACH

replace some retail store cash payments in the future, but ACH, ATM, and telephone transfer payments are too cumbersome to replace cash in small transactions. Checks, credit cards, money orders, and traveler's checks generally are used for middle-sized transactions. POS systems could replace many of these transactions in retail stores. For routine payments, such as those to utilities and loan payments, ACH, ATM, telephone transfer, and home banking could be substituted. ACH also can be important in payroll disbursement. High dollar payments are almost exclusively corporate-to-corporate transfers or interbank financial market transactions via wire transfer networks.[1] For some of these, the Corporate Trade Payments (CTP) ACH may provide an effective substitute. Table 1-3 illustrates the main substitutions possible by dollar amount between major nonelectronic and electronic payment methods.

The most important substitution from a social viewpoint would be between checks and electronics, since check payments constitute 92 percent of the nonelectronic payment dollars and, as shown in a later section, are the most socially wasteful of resources. The current distribution of check usage among individuals (55 percent), businesses (40 percent), and government (5 percent) is shown in Figure 1-1, along with their likely electronic substitutes. The three most important classes of transfers—individuals writing checks to businesses (49 percent), businesses writing checks to businesses (23 percent), and businesses writing checks to individuals (16 percent)—generally have different potential electronic substitutes requiring different

Figure 1-1. Percentage Composition of Check Usage.



Note: Electronic substitutes are shown in parentheses.

electronic access arrangements. For example, direct access to electronic payments is needed for government and business, but indirect access—through ATM, POS, or telephone transfer systems—is required for individuals, as shown in parentheses in Figure 1-1. Clearly, substantial investment and effort will be required to break the public of its check-writing habits.

The remainder of this section broadly outlines demand and supply relations for payments instruments. Future changes in technology, institutions, and industrial structure can lead to substitution of electronic for nonelectronic payments methods through these demand and supply functions. Following sections will outline how these changes might occur.

Demand and Supply for Payments Instruments

The demand for a payment instrument can be expressed notationally as:

$$D_i = f(P(U)_i - P(U)_j, V, \text{DIS}, \text{POP}, \text{AS}, Y, R) \qquad (1\text{-}1)$$

where:

- D_i = demand for payments instrument i relative to total transactions (the latter are assumed to be fixed);
- $P(U)_i$ = own user price;
- $P(U)_j$ = user prices of alternative payments instruments;
- V = value of the transaction;
- DIS = distance of users to the closest bank branch, cash dispensing facility, or other payments service supplier;
- POP = population growth;
- AS = age structure of the population;
- Y = income level of users; and
- R = race of users.

The relative demand function in equation 1-1 is straightforward except for the formulation of relative user prices. The total demand for payments instruments is assumed to be exogenous, depending upon the transactions that individuals and firms choose to make. The distribution of transactions across payments instruments depends on the differences among user prices of alternative instruments; $P(U)_i - P(U)_j$ is the extra payment the user must make for use of instrument i rather than instrument j. The user cost of payments, $P(U)$, has three cost components, each springing from a different source:

$$P(U)_i = P(S)_i + \text{MHFC}_i - \text{FTP}_i \text{ with } \text{FTP}_i = r \cdot A_i \cdot V_i \qquad (1\text{-}2)$$

where:

- $P(S)_i$ = supply price of instrument i charged by the payment supplier, such as a per-check fee;
- MHFC_i = Merchant Handling and Float Charge—what the payee charges the payor for using instrument i over and above the price of the good or service being purchased for the purpose of recovering payment

handling and float costs, such as a premium for using a credit card at gas stations;

FTP_i = Float Transfer Payment—interest earned by the payor from the time of payment until the time good funds are passed. Payors typically do not compensate payees for float because of high negotiation costs and because of the custom (legal and social) that debts are considered paid when instruments, rather than good funds, are passed. FTP can be negative if, as for cash, traveler's checks, or money orders, good funds are passed prior to the transaction;

r = daily market interest rate; and

A_i = average number of days until collection of funds from the payor (or the debit to his account).

$P(S)$ is charged directly by the supplier of the payments instrument. We assume for simplicity that $P(S)$ is directly assessed on the payor. MHFC is the fee charged directly by the merchant or other payee which may or may not differ across payment forms. The merchant's price $P(M)$ includes the basic cost of (and normal return on) goods and services $P(G\&S)$ plus the merchant's payment handling and float costs:

$$P(M)_i = P(G\&S) + \text{MHFC}_i \quad . \tag{1-3}$$

$P(G\&S)$ may be thought of as the price the merchant would charge if customers would deposit immediately available funds in the merchant's bank account instead of having him handle the payment transaction. Merchants have no doubt attempted to pass on to the consumer the marginal costs of handling different payment instruments (MCH_i) plus the costs of float (FTP_i). Usually, merchants raise the price for using *all* payments instruments equally using a weighted average of the handling and float costs. They set all $\text{MHFC}_i = \text{MHFC}$, where $\text{MHFC} = \Sigma\, n_i\,(\text{MCH}_i + \text{FTP}_i)$ and n_i is the proportion of transactions using instrument i—rather than recovering the costs for each instrument separately by setting each $\text{MHFC}_i = \text{MCH}_i + \text{FTP}_i$. The firm in effect "subsidizes" the use of the high-cost instruments and "taxes" the use of the low-cost instruments.

Cross-section survey studies of the use of different payments instruments (e.g., Little 1975; Pierce 1977; Survey Research Center 1984) usually have not determined the impacts of user prices, as these are difficult to measure. These studies have, however, shown

that payments usage differs considerably with the value of the underlying transaction (V), the distance of the user to the supplier of payments services (DIS), population growth (POP), and the age (AS), income (Y), and race (R) of the user. These variables all attempt to capture the different tastes, perceptions, and other user-incurred costs which are not otherwise directly measurable. The specific impacts of these variables can be summarized as follows:

- Value of the transaction (V): Related to safety, convenience, regularity of payments, and relations between payor and payee. Small, infrequent transactions between anonymous participants are most easily handled in cash or by POS which give payment in nonprovisional funds requiring no complex certifications. Middle-sized regular payments are suited to checks, POS, ACH, or ATM to avoid the safety problems of cash. Large transactions often involve sending immediate funds without personal contact, requiring use of wire transfers. Regular large business transactions may also be handled by CTP ACH.
- Distance to a payments service facility (DIS): This variable is particularly important in influencing the relative use of cash versus checks for those users with checking accounts (80 percent of the population). Distance to a bank branch, or to an ATM or CD, reflects the convenience aspect of being able to withdraw cash. Some studies indicate that the increasing convenience of cash withdrawal made possible by ATMs and CDs has lowered the public's average holdings of idle cash balances (while the growth of the underground economy has moved cash holdings in the opposite direction).
- Population growth (POP) and age structure (AS): Domestic U.S. use of cash and checks for normal consumer transactions are affected by the overall expansion of the population and its division into adult and nonadult age classes due to consumer inertia, electronics anxiety, and so on. Current use of ATMs, CDs, POS, and ACH for bill payments are primarily concentrated in the young adult age groups. However, these variables do not affect financial market transactions (e.g., interbank funding, foreign exchange transactions, and U.S. government securities transfers), which dominate wire transfer volume.
- Income level (Y) and race (R) of user: Income and race are empirically associated with the use of credit cards and checks versus

cash and money order use. Use of provisional funds (credit cards and checks) is restricted by past and present discrimination and persists in part due to consumer inertia, favoring the use of final funds methods (cash and money orders) for lower income and nonwhite groups. In addition, the availability and size of credit lines on credit cards and overdraft protection for checks is related to income level.

We assume an oligopolistic pricing mechanism for payments. The supply price of payments instruments takes the form of a multiplicative markup over the unit costs of a firm:

$$P(S)_i = m \cdot g(P_{wi}, P_{ki}, P_{Ii}, Q_i, Q_j, t_i) \qquad (1\text{–}4)$$

where:

$P(S)_i$ = unit supply price of the i^{th} instrument offered by a payments-producing or supplying institution;

m = markup factor, where $m = 1$ indicates that normal profits are being earned;

$g(\cdot)$ = short-run unit cost function which includes normal profits;

P_{wi}, P_{ki}, P_{Ii} = the unit costs of labor, capital, and intermediate inputs or services that are used to produce the i^{th} payment instrument;

Q_i = the level of output produced, to capture scale effects;

Q_j = vector of all other payment instruments produced by the firm, to capture scope effects or complementarities in production; and

t_i = technological changes not already embodied in the unit cost of capital (P_{ki}).

The supply function in equation 1–4 is entirely technologically determined, except for the markup factor m. The producer "subsidizes" the use of payment instrument i if $m < 1$ and "taxes" its use if $m > 1$.

Given the notational framework of the demand and supply relations 1–1 to 1–4, we may now more clearly state our central thesis. To date, the electronics revolution in payments has not arrived because institutional factors have dominated the technological determinants of the user price of payments instruments. In particular, the influences of high handling costs (MHC) and high float transfer payments (FTP) on checks and credit cards, which are typically not offset by differentiated merchant charges (MHFC), have dominated the

influences of scale economies (Q_i), scope economies (Q_j), and embodied and disembodied technological change (P_{ki} and t_i). Moreover, the marketplace is likely to remain this way until the emergence of interstate banking. Interstate banking will help induce the electronic revolution by (1) reducing float transfer payments (FTP) by speeding check collection (by reducing A_i on checks), and (2) introducing check truncation and electronic check collection on a widespread basis, so that ACH scale and scope economies can be exploited (increasing electronic Q_i and Q_j). The remainder of this chapter more fully describes the technological and institutional determinants of payments usage and how institutional changes can affect usage patterns in the future.

USER PRICES AND SOCIAL COSTS OF PAYMENTS IN TODAY'S INSTITUTIONAL ENVIRONMENT

This section gives estimates of the user prices and social costs of the major payments instruments. We show the prospects for changes in costs due to exploitation of scale economies, given the current institutional environment. We also demonstrate how the legal status of check payments and the structure of the banking industry have combined to make check float a primary determinant of payments patterns in the United States.

Three important conclusions are drawn from this analysis. First, checks are used too frequently because of the float benefits that accrue to users. ACH payments use about one-half the real resources used by check payments, so that substitution of ACH for checks is in the public interest. Second, even when only "back office" operations are considered, ACH unit processing costs would likely be substantially lower than check unit processing costs if a substantial proportion of checks were truncated, indicating that truncation is in the public interest. Third, neither of these changes are likely to occur in the current institutional environment. The vast majority of consumers are unlikely to replace checks with electronic payments as long as check float is protected by statute and custom. In addition, interbank negotiation to reduce float is effectively blocked by the large number of relatively small institutions in today's banking industry.

User Price versus Social Cost of Payments Instruments

Table 1–4 shows the estimated real resource costs, transfer payment costs, and total user charges and prices for each of the major payment methods. It may be seen that the real resource costs are of only secondary importance for most transactions. For checks and cash, which together account for 96 percent of all transactions, the transfer payments involved (column 3) outweigh the real resource costs (column 5). A critical difference is that cash users *pay* this transfer payment (to the government) while check users *receive* this transfer payment (from payees). In either case, there is a substantial wedge between the private and the social costs of a payments transaction with these two instruments. These wedges lead to market failure and encourage overuse of checks and credit cards and underuse of cash from a social viewpoint. Electronic payments, alternatively, have little or no float.

Because of check float, the imputed user price is $-.15 per check transaction, as opposed to $.33 for ACH, indicating that, on average, a user receives $.48 for using a check instead of an ACH transaction. This is despite the fact that check transactions are twice as costly in terms of real resources, $.68 for checks versus $.34 for ACH. Similar results, but to a lesser degree, also hold when comparing checks with other electronic alternatives, such as ATM and POS. As a result, it is difficult to believe that technological change, which can at best only reduce the cost of electronic payments to some lower positive level, will be the sole determining factor in inducing users to shift voluntarily away from checks to electronics.

In addition to any technological developments, institutional changes must be made to offset the float benefits of check writing before significant substitution will occur. Evidence of the lack of substitution into electronics to date substantiates this claim. Electronic payments have captured the small market share they have because the users have received some compensation for substituting electronics for checks, credit cards, or cash. POS and ATM use in bill payment has been associated with price discounts (e.g., POS use in gas stations) or increased convenience and postage cost savings (e.g., ATM use in bill payments). These inducements resemble reductions in electronic MHFC or an increase in check or credit card MHFC.

Table 1-4. User Prices and Social Costs of Different Payment Instruments, 1983 (*in millions of dollars*).

Type of Payment Instrument	*Production Cost (unit cost)*	*Processing Cost (unit cost)*	*Total Social or Real Resource Costs (unit cost)*	*Float Transfer Payment (positive for cost; negative for benefit) (unit cost)*	*Total User Charges*[h] *(unit price)*
	(1)	(2)	(1) + (2) = (3)	(4)	(3) + (4) = (5)
Nonelectronic					
Cash	$ 327 (.00)	$ 7,195 (.06)	$ 7,522 (.07)	$13,604[f] (.12)	$20,648[i] (.18)
Checks	1,250 (.03)	25,828 (.65)	27,078 (.68)	-33,007[g] (-.83)	-5,922 (-.15)
Credit cards[a]	2,208 (.44)	2,191 (.44)	4,399 (.88)	-2,208 (-.44)	2,191 (.44)
Money orders[b]	855 (1.14)	472 (.63)	1,327 (1.77)	210 (.28)	1,537 (2.05)
Traveler's checks[c]	701 (.88)	360 (.45)	1,061 (1.33)	0 (.00)	1,061 (1.33)
Electronic					
ACH	0 (.00)	137 (.34)	137 (.34)	-6 (-.02)	131 (.33)
ATM transfers[d]	13 (.17)	32 (.43)	45 (.60)	3 (.04)	48 (.64)
POS[e]	3 (.16)	8 (.44)	11 (.60)	0 (.00)	11 (.60)
Wire transfers	0 (.00)	297 (5.21)	297 (5.21)	5 (.09)	302 (5.30)

a. According to a Bank Administration Institute study (unpublished) referenced in the *American Banker* (April 9, 1985: 16), bank credit card transactions are outstanding an average of forty-five days. Thus, total credit card float costs are estimated to be $2,208 million (from $208 billion in yearly charge volume in Table 1-2 divided by 365 days times 45 days a transaction is outstanding times the 90-day Treasury bill rate of 0.0861). Credit card production costs—which include the costs of issuing the cards, maintaining the accounts, and paying the merchants—on average equaled the cost of float ($2,208 million, *American Banker* referenced above). Retail or merchant processing costs were $.44 per credit card transaction, giving a total processing cost of $2,191 million (from 4,980 million card transactions in Table 1-2 times $.44 from Board of Governors of the Federal Reserve System 1983: 43). Thus, the total social (user) costs of credit card transactions are estimated to be $4,399 ($2,191) million, with a unit cost estimate of $.88 ($.44) per transaction.

b. Federal Reserve costs in processing 135 million postal money orders in 1984 was $2.6 million (direct costs plus allocated overhead costs from *PACS*, 1984) or $.19 per money order. This unit cost figure was applied to the 750 million money orders estimated to have been used in 1984 (from Table 1-2) giving $14 million. Merchant or receiver processing costs were assumed to equal that reported for checks at a sample of retail stores of $.50 per item for a total merchant processing cost of (750 million money orders) ($.50) = $375 million (Board of Governors of the Federal Reserve System 1983: 43). It was assumed that one-half of all money orders are mailed by the user, giving an extra user cost of $83 million (from postage ($.20) plus envelope costs ($.02) times 0.5 (750 million items) = $83 million). This assumption is supported in a survey of money order users in California by Pierce (1977), who found that the payment of utility and other monthly bills plus sending money to relatives or friends accounted for almost two-thirds of the responses as to why money orders were used (table A-3, p. 8, appendix). Total money order processing costs are thus estimated to be $472 million. The costs of producing a money order, including all costs of distributing them to users plus the costs of redemption, are taken from postal money order *fiscal* year data for 1984 (and thus will not exactly agree with the volume and value figures for postal money orders processed by the Federal Reserve in *calendar* year 1984). The directly allocated production costs for postal money orders were $.72 per item ($83 million in directly allocated cost/116 million items in fiscal year 1984 from U.S. Postal Service, 1984). Revenues, however, were $1.42 per item ($165 million in total revenues/116 million items). All revenues (which includes $33 million in float benefits to the Postal Service) in excess of directly allocated costs of $83 million are allocated to Postal Service overhead. Since the Postal Service views these overhead costs to be joint costs, they make no attempt to determine the fully allocated cost of a postal money order. Thus, it is impossible to determine if revenues cover all costs or if excess profits (or losses) are being incurred and cross-subsidization exists. However, given the Postal Service's regular use of Ramsey pricing principles in pricing all its mail services, we assume that the unit float costs per money order of $.28 (from $33 million in float revenues/116 million items) were in excess of the underlying resource costs of production of $1.14 per item (from $165 million in revenue less $33 million in float benefits divided by 116 million items). This assumption is at least partly supported by Penzer (1978: 6), who notes that use of the postal money orders peaked in 1952, and has subsequently lost market share to bank issued money orders and other private firms, implying a lack of competitive pricing by the U.S. Postal Service. Money orders are estimated to be outstanding between 5 and 11 days (Penzer 1978: 8). Thus, total production cost is $1.14 (750 million items) = $855 million for a total social cost of $1,327 million. Total user costs are $210 million higher because of float costs (from $.28 times 750 million items).

(*Notes to Table 1-4. continued overleaf*)

Notes to Table 1-4. continued

c. Production, processing, and operating costs for traveler's checks is proprietary. Thus, it was assumed that revenues associated with issuing traveler's checks equaled the costs involved. Generally, an issuing fee of 1 percent of the face value of the traveler's check is assessed, yielding a revenue flow of $279 million (from 0.01 times $27.9 billion in Table 1-2). Further revenue to the issuer is obtained from float, since the average traveler's check is estimated to be outstanding for sixty-four days (see Table 1-2). (Penzer 1978: 32 estimated that a traveler's check is outstanding for an average of fifty-seven days in 1976.) Float revenues to the issuer are $422 million (from 0.0861—the 90-day Treasury bill rate in 1983—times $4.9 billion which was the average daily value of outstanding traveler's checks noted in Table 1-2). Thus, the costs of issuing and paying traveler's checks, which would also cover the expense of funding lost checks, is $422 million plus $279 million for a total of $701 million. The retail cost of handling traveler's checks is assumed to be equal to that for cash ($.45 per transaction (Board of Governors of the Federal Reserve System 1983: 43) which yields a cost of $.45 (800 million transactions in Table 1-2) = $360 million. While there is float associated with traveler's checks (($422 million in float) (800 million transactions) = $.53 in float costs per traveler's check), we have assumed that all float revenues in fact cover operating costs so float, in the same sense as check float, or the opportunity cost of holding idle funds, in the same sense as applied to the issuance of cash by the government, does not exist. Put differently, traveler's check float is not the same thing as a redistribution of income between payor and payee but rather an alternative method of covering operating expenses for the issuer of the traveler's check. Since this is a reasonably competitive industry, we have assumed that there is no monopoly power on the part of the issuer to obtain above normal profits (such a situation does not apply to the issuance of currency by the government). In sum, the user and social costs of a traveler's check are the same at $1.33 per transaction ($701 million plus $360 million divided by 800 million transactions).

d. The cost per ATM transaction was reported to be between 50¢ and 60¢ in Bank Administration Institute, 1985: 4. A per-transaction cost of 55¢ was used plus 4.7¢ for ATM bill payments processed through an ACH, giving 59.7¢ in Table 1-4. Total ATM social costs were estimated from 59.7¢ per ATM bill payment times 75 million transactions shown in Table 1-2, giving $45 million. The ATM transaction cost was allocated to production and processing cost categories on the basis of a percentage distribution breakdown shown in the source referenced above (32% of ATM costs were for installation and equipment, similar to production cost; 68% of ATM costs were for operations, administration, and processing). The ACH processing cost of $3.5 million was added to ATM processing costs. There can be a float cost associated with ATM usage for bill payment since, if the ACH is used to credit the payment receiver's account at another institution, a customer initiated bill payment (an ACH credit transfer) will be processed the next day on the ACH day cycle with at least a one-day funds availability schedule for the payee. Thus, an ATM bill payment processed through the ACH will cost the payor two days in float, or around $3 million (from 2/365 times $5.3 billion in bill payments from Table 1-2 times the 90-day Treasury bill rate of 0.0861). That is, the customer's bank will debit his account on the day he initiates the ATM transaction but the bank will itself be debited perhaps two days later if the bill payment is processed through an ACH, giving the customer's bank two days of float.

e. Lacking strong evidence to the contrary, we assumed that the unit cost per POS transaction would equal that for an ATM transaction (59.7¢). This per unit cost times an estimated volume of 19 million (in Table 1-2) gives a total social cost of $11.3 million, which was then allocated to the production and processing cost categories using the ATM percentage distribution figures noted in footnote d. There is no float associated with POS transactions so the user and the social costs are the same.

f. This figure is the opportunity cost of holding idle cash, or the seigniorage payment to the government.

g. The cost of holding funds earning little or no interest in a checking account is assumed to be soft-dollar payment for services and is therefore included under production and processing costs, rather than float costs.

h. The supplier prices are assumed to equal unit costs, that is, the multiplicative markup $m = 1$. The user charges and unit prices of the different payment instruments reflect all handling costs and float benefits attainable to each instrument, even though these costs are not always fully reflected in merchants' prices.

i. This figure excludes the government production cost of $327 million and the portion of processing costs borne by the Federal Reserve, $151 million, both of which are provided free. The remaining private sector costs are assumed to be passed onto cash customers through higher prices.

Source: Humphrey (1984: 14) for all data on cash, checks, ACH, and wire transfers. Other data sources are noted in the lettered notes.

The most successful consumer switch into electronics to date—the substitution of an ATM or CD cash withdrawal for an "on-us" check written for cash at a bank branch office—has occurred because of an increase in convenience due to improved hours, shorter lines, or multiplicity of locations. All of these are similar to a decrease in the distance to a payments supplier (DIS). On the business side, the Corporate Trade Payment ACH program works only because the participants are able to retain their estimated distribution of check float benefits while using electronic payments. This is similar to reducing MHFC for ACH and raising it for checks to cover the float costs involved (FTP).

The largest single user of ACH—the U.S. government, which accounts for about 60 percent of current ACH volume—uses it not because of direct savings but because of the social benefits involved. Although this is stretching the point, we may think of the government as a rational consumer, setting its own merchant charge on checks equal to the float transfer payment, so that transfer payments from taxpayers to government income recipients are ignored in decisionmaking. Dudley's (1984) analysis of the government's ACH direct deposit program supports these conclusions, finding that government ACH is socially beneficial and that the user price of checks to the government is negative, as was the case for all check usage in Table 1-4. He finds that the real resource costs of government payments are $.27 for an ACH direct deposit and $.40 for a check payment. However, the government gives up $.66 in check float for each transfer made by ACH direct deposit, so that the user price of a government check is $-.26 ($.40 in real resource costs less $.66 in check float benefits). Thus, it "costs" the government $.53 per payment via ACH direct deposit ($.27 less $-.26), which it pays for the purpose of increasing social welfare. These independent estimates of user price and social costs between checks and ACH for one important user mirror the estimates for all users shown in Table 1-4.

Technological Determinants of User Prices: Scale Economies in Payments Processing

The question arises as to whether technologically induced cost changes can change prices enough to induce significant payments substitution by users. In the discussion below we concentrate of nec-

essity on scale economies rather than scope economies or future technological innovations, as little information exists on the latter categories. However, as will be seen, even if improving techniques are heavily biased toward electronic payments instruments, large-scale user substitution seems unlikely without institutional changes.

Cash-Processing Scale Economies. Cash-processing operations at Federal Reserve offices, the only group of processors for which data are available, were shown to experience scale economies at low processing volumes but scale diseconomies at higher volumes (Zimmerman 1981). Federal Reserve coin and currency processing operations are (largely) provided without charge to users as a "free" central bank service. However, this subsidy of $151 million plus the subsidy of $327 million in production costs from the U.S. Treasury together are too small to offset substantially the opportunity cost tax on holding idle cash balances of over $13 billion. Private sector cash handling and processing costs, on the other hand, presumably are passed on to users. Assuming that private sector processing techniques have properties similar to those of the Federal Reserve, it appears unlikely that significant cash price changes will occur as a result of scale economies in the future.

Check-Processing Scale Economies. Estimates of Federal Reserve check-processing costs, using a translog cost function, suggested a U-shaped average cost curve prior to the pricing of this service (Humphrey 1981; Zimmerman 1981). Diseconomies of scale prevailed at the majority of Federal Reserve offices. Pricing this service led to an overall reduction of 25 percent in market share from 1981 to 1983 and, subsequently, the Federal Reserve experienced constant average costs (near the bottom of the U) at each of its forty-eight offices (Humphrey 1985). Scale economy estimates are not available for the private sector's check operations. However, the same production techniques are used by both Federal Reserve and correspondent banks so that it is reasonable to assume that the private sector also experiences constant unit costs. Therefore, check unit cost changes that substantially offset the user price advantage due to check float are unlikely in the future.

ACH Scale Economies. Estimates of ACH scale economies have used a translog cost function with five sets of annual cross-section

Wire Transfer Scale Economies. Thirty-two of the thirty-six Federal Reserve wire transfer offices, representing 98 percent of the volume, were processed at offices experiencing constant average costs. When all offices were restricted to have the same SCE, the SCE ranged from 0.97 to 1.04 for three years, 1977–1979, and none of these annual estimates were significantly different from constant average costs (Humphrey 1984).

Data do not exist to estimate the SCEs that apply to wire transfer networks operated by the private sector. CHIPS, the largest private sector network, processes half the transaction volume of FedWire and two-thirds of the dollar value. Other networks, such as Cash-Wire and CHESS, are very small and can be safely neglected at this time. SWIFT and BankWire are message transfer networks that rely primarily on FedWire and CHIPS to obtain the correspondent balances used to transfer funds in accordance with the messages sent.

ATM and POS Scale Economies. Estimated scale economies in automated teller machines are significant. Walker (1978, 1980) estimated ATM SCEs to be 0.26 to 0.50, both significantly different from 1.[2] However, 98 to 99 percent of all ATM transactions are *not* bill payments but reflect cash withdrawal (76 percent), account deposits (19 percent), or account transfer operations (4 percent—Cox and Metzker 1983). No known empirical analysis has been performed on the degree of scale economies in POS use, although the popular press and knowledgeable banking sources assert that such economies exist. At this point the volumes of POS transactions are so small that little of a definitive nature can be said as to how costs will behave as volumes reach mature levels.

It is useful to emphasize that ATM and POS systems typically are not in themselves complete electronic payment systems. Banks complete ATM bill payments by directly crediting the payee's account, by ACH transfer, or by mailing a check on behalf of the payor. Most POS systems allow customers of *different* banking organizations to initiate a payment to, say, a supermarket. The funds are then moved from the customer's bank to that of the supermarket by means of an ACH transfer. In the case of a proprietary POS system where only *one* banking organization has access, the POS transaction will likely be a transfer between the customer's account and the supermarket's account internal to the same bank.

ACH as a Substitute for Check Processing

Technologically induced changes in user prices are unlikely to be sufficient to overcome the current float-induced advantage of checks at the retail or user level. A remaining possibility, however, is that ACH may be substituted for check collection at the wholesale or back office level. Banks may find it cost effective to truncate checks at the bank of first deposit or some other intermediary (correspondent bank or the Federal Reserve) and have the payments processed, transported, and collected via ACH. Check safekeeping by itself, that is, truncation at the payor bank without processing and collection by ACH, would save payor banks an estimated $7 per year per customer in postage and handling expenses (*Wall Street Journal* 1985), or about $.03 per check. Use of ACH in the interbank collection process offers an additional possibility of savings. Berger (1985) suggests that about $.03 per item could be saved by truncating checks at the bank of first deposit and transmitting the relevant payment information by ACH. Safekeeping and truncation together could save around $.06 per item.

Although check truncation and ACH collection could be cost effective in terms of real resources, it is unlikely to occur on a widespread basis in the near future without institutional change. While collecting banks would save resources, payor banks (or their customers, or both) would give up some float benefits and the legal right to inspect the item and verify the signature prior to payment. As shown below, the current structure of the U.S. banking industry makes the negotiation costs required to arrange truncation prohibitively high.

Institutional Determinants of Payments Usage: The Check Float Barrier

Float exists because all payments instruments do not involve the instantaneous or "same day" transfer of immediately available or final funds between payor and payee. Payment instruments that generate little or no float for the payor are cash, money orders, traveler's checks, ACH, wire transfer, POS, and ATM bill payments. Cash, money orders, and traveler's checks in fact cause a loss of float by both the payor and payee that is recovered by the issuer. For our

purposes, all of these will be considered to be "no-float" payment instruments since the payor generally gains no float advantage and uses them for other reasons.

Checks and credit cards, in contrast, embody substantial amounts of float gains to payors, which are offset by float losses for payees, so that float is a transfer payment. Unfortunately, real resources are spent to influence the distribution of this transfer payment. Payors spend extra resources to disburse checks from points remote to the payee (or the payee's collecting bank) to increase mail plus interbank float, the total time between when the payor sends the check and presentment occurs at the payor bank for payment in final funds. In response, payees and collecting banks spend extra resources to offset these payor strategies by reducing their processing and collection times through the use of costly expedited collection procedures (for example, use of special ground or air couriers in place of slower but less costly regularly scheduled bus, truck, rail, and air transportation alternatives).

The problem of check float is unique to the United States among developed economies. This is due to historical differences in institutional evolution. Other nations either do not rely so heavily on checks or have solved the problem of float by negotiation among the banks.

In most European countries the giro system has evolved in place of what would otherwise have been the checking system. A giro payment is a credit transfer between the accounts of the payor and payee, which are typically located at a post office. In a giro system, float does not occur because the payor's account is debited and the amount is credited to the payee's account simultaneously. Thus, payment processing and collection occur at the same time. A giro is similar to an ACH credit transfer in the United States. The closest check equivalent to a giro is an on-us item, where debiting and crediting take place the same day. However, the payor still generally earns float on an on-us check, since payment is usually considered completed when the check is transmitted to the payee, which is often in advance of the check's deposit at the bank.

In Japan, on the other hand, both cash and electronics are more heavily used. Until recently, workers were usually paid in cash. The current trend is toward using a system of transfers on magnetic tape handled by the Tokyo clearinghouse, similar to direct deposit ACH. The dominant form of noncash transaction in Japan is the direct

debit, where individual payors may transfer funds directly into the payee's account using a private sector wire system (the *Zengin*). Checks and giro transfers are used only by businesses. The one exception to the Japanese rule of little or no float is an increasing use of credit cards.

We now turn to a comparison of the U.S. system with the Canadian system. Both of these countries rely heavily on check usage for retail payments but have evolved a substantially different treatment for float.

Check float results because checks are essentially sight drafts subject to signature verification prior to payment and because it takes time to receive, process, and transport a check for presentment and signature verification at the payor bank. In the United States the collection and verification process has evolved historically with few major changes, other than those aimed at standardizing the size of the check, the placement of the payment order information, and the magnetic ink encoding of the payor bank and customer account number. These changes have expedited the processing, collection, and presentment process but substantial payor float still remains. The rights and liabilities governing checks are covered extensively in the Uniform Commercial Code (UCC); those pertaining to electronic payments are less clear legally because of their relative newness.

Canada also relies heavily on checks, but payor float has been virtually eliminated. For checks written by consumers, the major Canadian banks have negotiated away much of what would otherwise be payor float benefits from check use by agreeing that checks drawn on one another will be paid on the same-day basis, even though settlement between the banks occurs the next day. For large dollar business checks (over $50,000), float costs are assessed on the payor, not on the payee as in the United States. These negotiated arrangements were made possible because:

1. the Canadian banking system is very concentrated—five major banks operating nationwide account for more than 90 percent of total banking assets;
2. this concentration is relatively even in different regions since an extensive national branching network exists for these five banks; and
3. the major banks have roughly equal shares of the consumer deposit market and, therefore, the check market.

The first condition implies that negotiation and coordination costs among the Canadian banks will be relatively low compared to the United States, where negotiation among 3,283 banks would be necessary to cover 90 percent of U.S. banking assets.[3] Negotiation is necessary since each bank offering same-day funds availability incurs float costs that could only be offset by the reciprocation of other banks. The first condition also means that more on-us checks will exist. These require no processing past the bank of first deposit since the funds are transferred between accounts at the same bank.

The second condition, the geographical dispersion of Canadian banks, also permits transit items, those checks drawn on other institutions, to be collected overnight at low cost. This is made possible because presentment for collection at any branch office of a bank is permitted, even if the payor's account is physically located at a branch office distant from where the check was deposited.

In the United States, on the other hand, interstate and intrastate commercial bank branching prohibitions and regulations requiring presentment at each of 15,047 head offices or 40,913 branches of these banks make for a slow, cumbersome, and expensive system of exchanges (FDIC 1983: 6). Each transit item in the United States is handled more than three times on average (Berger 1985), and the Federal Reserve has found it necessary to establish forty-eight check-processing offices nationwide, since no commercial bank may branch nationwide.

The importance of the third condition, equal shares, is that the principals to the negotiation have roughly equal stakes in its success. The overall loss in float benefits by one bank's retail payor customers, through a same-day debit to their account for the checks they wrote to payees of different banks, is basically offset by the improved availability these customers receive when they are payees and deposit checks drawn on other institutions. The customers of one bank are not disadvantaged relative to customers at another bank.

In sum, the evidence presented in this section has shown that the existence of large amounts of check float encourages the overuse of checks. This incentive is unlikely to be reversed by technological change since the real resource costs are less than the float benefits of check usage. Check truncation with electronic collection via ACH is a possible socially beneficial substitution of electronics for checks at the back office level which requires only a minor change in consumer behavior. However, this is unlikely to occur without institu-

tional changes within the banking industry which will make a negotiated settlement of interbank float costs and benefits cost effective and where the otherwise external benefits can be internalized.

TYPES OF INSTITUTIONAL CHANGE THAT MAY LEAD TO INCREASED USE OF ELECTRONIC PAYMENTS WITHOUT INTERSTATE BANKING

In this section we examine institutional changes that could induce significant substitution into electronic payments without requiring a change in the current banking structure, which is covered in the next section. Five possible institutional changes are:

1. change of the legal rights and liabilities regarding check payments, so that check payors (or their banks) could be charged directly by payees or collecting banks for the processing and collection float they create by using checks;
2. widespread adoption of merchant handling and float charges differentiated by payment form, especially surcharges for checks and credit cards, which would reduce or eliminate the current cross-subsidization of check and credit card users through higher and undifferentiated prices to all consumers regardless of the payment method used;
3. widespread installation of POS systems by merchants to facilitate the use of debit cards in place of cash, checks, credit cards, money orders, and traveler's checks;
4. widespread institution of direct fees to users on checks, credit cards, and other payment instruments by the payments suppliers which cover their full costs; and
5. adoption by businesses of the ACH Corporate Trade Payments program for most business-to-business payments, where the distribution of check float benefits are unchanged but the cost-reducing benefits of electronic payments can still be realized.

The first institutional change would affect check payments by all types of users. The second, third, and fourth changes would affect consumer payments to business, which account for 49 percent of all check payments. The fifth institutional change would impact business-to-business payments, which account for 23 percent of check payments (see Figure 1–1).

dollar amounts, to develop and utilize alternative electronic payment methods.

Unfortunately, after extensive legal analysis, it was concluded that a sufficiently strong legal case could not be made for charging the payors. This was in spite of the fact that a strong economic argument could be made for charging the payor as the float's beneficiary. The UCC, as written and interpreted by the courts, instead supported a float cost charge on the collecting bank (and payee), not on the paying bank (and payor). From a legal point of view, Reserve Banks were seen to be providing a processing and collection service to the collecting bank, not the paying bank, so the legal rationale for shifting float costs to payors was weak.[4] Past efforts to alter the UCC regarding different issues suggest that any attempts to permit collecting banks to charge payors expressly for the cost of check float would be very difficult to achieve.

Changing Retail Pricing Practices

For large dollar intercorporate or financial transactions, it is customary to negotiate the method and timing of payment. For small-to-moderate dollar value retail transactions, however, another custom has evolved. For these transactions, the per-dollar payment cost of direct negotiation is prohibitively high and price differentiation by payment means is viewed as competitively disadvantageous. Merchants have instead chosen to fold their float costs and payment-handling costs into a single price for the good or service.

The differences among the float and handling costs for different payments instruments can be substantial. Firms that accept checks and credit cards for payment require greater working capital to finance the float they absorb and incur higher labor costs for the extra time spent in handling these transactions. For example, supermarkets must keep extra checkout lines staffed because validation of checks takes so much longer than cash. In addition, merchants that accept provisional funds bear more risk and often must pay outside agents (e.g., Telecheck, Visa) to absorb risk and handle some of the additional paperwork and payments processing.

In terms of our demand and supply model, merchants who do not price differentiate among payment instruments set the merchant handling and float charge equal for all instruments: $\text{MHFC}_i = \text{MHFC}$ for all i, and all customers pay $P(M) = P(G\&S) + \text{MHFC}$. We

assume that merchants attempt to pass all these costs forward at the margin to customers, so that MHFC is set to recover all marginal handling and float costs MHFC = $\Sigma n_i (\text{MHC}_i + \text{FTP}_i)$, where n_i is the proportion of customers using instrument i. Merchants in effect tax customers that use low-float, low-handling cost instruments like cash and electronics, where MHFC $>$ $\text{MHC}_i + \text{FTP}_i$, and subsidize users of high-float, high-handling cost instruments like checks and credit cards, where MHFC $<$ $\text{MHC}_i + \text{FTP}_i$, thereby encouraging the use of socially inefficient payment forms. Apparently, merchants generally choose to use uniform prices because of the belief that consumers prefer simplicity and this provides a perception of fairness.

The adverse impacts of uniform pricing are somewhat mitigated by merchant specialization by payment means. For example, some restaurants insist upon cash payment and others accept credit cards. Ceteris paribus, the latter will incur higher costs and charge a higher uniform price. Although some cash customers will pay the higher price, cash customers will pay less on average, since some of them will pay the lower "cash only" price.

Some price differentiation by payment method does occur today, but it is not widespread. Some gas stations offer discounts when cash is used rather than a credit card; other retail establishments refuse to accept checks or impose cumbersome credit verification procedures as nonprice barriers. Still other merchants apply minimum purchase requirements for check or credit cards. Many of the legal issues regarding premiums and discounts for users of different payment forms are as yet not fully resolved.[5]

Expanding the Availability of POS

Point-of-sale systems with debit cards have been in place for more than a decade, but their use is still restricted. Only about 10,000 POS terminals are in place nationwide. If POS terminals were made available to consumers on a widespread basis, there is a reasonable likelihood that these would be frequently used in place of cash, checks, and credit cards. In terms of our demand and supply model, making POS more available to the public is equivalent to reducing DIS, the average distance to the payments supply point.

The problem with setting up POS systems with widespread consumer access is that the externalities are spread over a large number of banks and stores. Given today's banking structure, the logical

choices for organizing POS networks are either interstate-branching chains of retail outlets, such as 7–11 stores, or payment service corporations such as Visa. Such networks may have limited success, however. There is a danger that individual banks that control the customer accounts may try to extract too much rent from the system by raising fees for its use. A similar pattern seems to be occurring presently, where some banks are charging fees to customers for using their ATM cards at another bank's terminal. As long as banks continue to have monopoly access to Federal Reserve payment settlement facilities, their negotiated cooperation will be required for any expansion of electronic payments to be successful. As long as the present banking structure remains, there will always be such difficulties of agreement.

Full-Cost Pricing by Direct Fees by Payments Suppliers

Banks typically offer "free checking" or charge per-check fees considerably less than the bank's handling costs and make up the losses on balance requirements or periodic fees. This practice evolved in part from legal restrictions on the payment of interest on deposits. To compete, banks subsidize payments as a crude form of interest payment. Similarly, credit card issuers generally charge no per-transaction fees—handling and float costs are recovered through annual fees, charges to retailers, and interest on tied loans. In terms of our demand and supply model, the supplier's multiplicative mark-up factor m for check and credit card purchases is near zero, giving an additional subsidy to use these payment forms. Similar to merchants who do not price discriminate by payment method, banks and credit card suppliers do not charge by the transaction in order to avoid complication and the appearance of inequity.

Changing Business Payment Practices

The development of electronic payments via the ACH through the Corporate Trade Payments program has been encouraging. In the CTP program the participants have:

1. calculated the average float obtained from check disbursements between themselves;
2. agreed to alter their trade credit terms to one another to offset the float benefits lost by using ACH transfers in place of checks; and
3. saved real resources by automating their internal processing of accounts payable and receivable by placing accounting, invoice, and posting information in the addenda records to ACH payment files.[6]

Although ACH processing of payment information can be cheaper than writing, disbursing, and otherwise handling checks, as seen in Table 1–4, this is not where significant real resources are saved. The important savings come from automating the other related payment/accounting/posting operations associated with the complete processing of payment information. During the transition period, however, a dual paper/electronic accounting system must be maintained. Therefore, most or all business payments will have to be in electronic form in order for each sender to internalize effectively what are now external benefits given to receivers.

Of the five institutional changes discussed, the last four have, in our judgment, a reasonable probability of future success. The CTP program is viewed as a likely future route for substantially increasing the use of electronic payments. To date growth has been slow. Although these changes may come about of their own accord, there is an additional institutional change that can by itself greatly expand the use of electronic payments and, in addition, serve as a catalyst to help bring about these institutional shifts on the retail level. This change is interstate banking.

INTERSTATE BANKING STRUCTURE AND THE FUTURE USE OF ELECTRONIC PAYMENTS

There are about 15,000 commercial banks in the United States, far more per capita than other nations, due to restrictions on within-state and interstate branching.[7] Canada has only one one-hundredth the bank density of the United States, with about one-tenth the population and deposits, but fewer than 15 domestically chartered

commercial banks. The next ten to fifteen years will likely bring an end to much of this disparity, primarily through mergers among existing U.S. institutions, as banking deregulation continues and interstate banking becomes possible.[8] Limited regional interstate banking is in fact now underway in certain parts of the United States. Also, the recent expansion of so-called "nonbank banks" across state lines has been, in part, another expression of interest in interstate branching by financial institutions.[9]

This section explores the possible and, in some cases, likely roles of interstate banking in the diffusion of electronic payments technology. The first and surest result of interstate banking on electronic payments will be a reduction in the float benefits from check writing, as the banking industry becomes more concentrated, with larger and more geographically dispersed correspondent banks. Second, there may be a widespread adoption of check truncation with interbank funds collection via ACH. This would substantially boost ACH processing output, allowing for exploitation of scale and scope economies.

Reduction of Float

The large number of banks in the United States requires a complex and costly payments system. Of the roughly 40 billion checks deposited by bank customers annually (Table 1–2), about 70 percent are items drawn on other banks. These must be physically sorted, transported, and presented to one of the other 15,000 banks before funds are transferred to the collecting bank. Bank mergers pursuant to interstate banking will significantly impact check-processing markets because:

- more checks will become on-us or nontransit items as the banking industry becomes more concentrated with larger participants, so that fewer will require any external processing (becoming transfers among accounts within a single bank); and
- those items requiring external processing—transfers between accounts located at different banks—will require fewer handlings as the larger and more geographically dispersed banks are able to transport and exchange items more efficiently through direct presentments and clearinghouse exchanges.

A simple measure of the net impact of these two market changes is the reduction in Federal Reserve market share in check processing (an inverse measure of the private sector share). Detailed, accurate data exist on current Federal Reserve volume, while little consistent information is available on the current characteristics and distribution of volumes across different private sector clearing arrangements. We therefore model the effect of interstate banking on the various components of the Federal Reserve's payments market share (Berger, Humphrey, and Frodin 1985). These results are combined with independent information to infer the effect on private sector clearing arrangements, so that all segments of the check payments market are covered.

Three dimensions of banking market structure that will change under interstate banking that are relevant to the payments market are:

1. *Bank Deposit Concentration* (measured by a Herfindahl index). More concentration will reduce the total number of externally processed (check plus electronic) payments.
2. *Bank Deposit Mass* (measured by average bank deposits and average bank office deposits). Larger banks and larger bank offices can take better advantage of scale and scope economies in processing and transportation.
3. *Bank Geographical Dispersion* (measured inversely by the proportion of all local banks' deposits that are located locally). Expanded branching into different locations can expedite incoming transportation and expand use of local clearinghouse exchanges for out-of-town items.

Our methodology uses existing cross-section data on banking structure (concentration, mass, and dispersion) and Federal Reserve and non-Federal Reserve check volumes to predict how the nation's payments system will look under full interstate bank branching, assuming that conventional collection methods continue to be used. All the information is sorted by the forty-eight Federal Reserve check-clearing zones to provide a cross-section data set. The endogenous variables to be explained are the proportions of checks deposited in each of forty-eight zones that are drawn on banks within and outside of the zone, and given these proportions, in which of the seven ways the checks will be cleared (five ways through the Federal

Reserve plus two methods that do not use the Federal Reserve). Multinomial Conditional Logit methods are used to predict the probabilities that checks will be cleared in each of these seven ways as functions of the banking structure variables and some demographic indices.

Several future interstate banking scenarios are simulated, each with its own implications for U.S. banking structure. The banking structures of California, New York State, and Canada are alternatively assumed to prevail in each of the forty-eight zones, an allowance being made in each case for some banks to operate on a nationwide basis. Simulations of the estimated model with California, New York, and Canadian data produce estimates of Federal Reserve check volume losses of 43, 60, and 93 percent, respectively. The California simulation example, which we believe best represents the likely outcome of interstate banking, is combined with independent estimates of the breakdown between internally and externally processed items.

The results provide some indication of the reduction in number of handlings and associated expenses that might result from interstate banking with conventional collection of check funds through presentment of the physical items at the payor bank. A large drop in the number of handlings implies a substantial reduction in interbank float. An upper bound to the reduction in the value of float benefits for check writers would be about $5 billion annually (out of $33 billion total check float). This would increase the user price of checks from $-.15 to $-.02 (see Table 1-4). This average increase of $.13 in the cost of check writing should lead to a decrease in the number of checks written. This would be especially true for large dollar items, which are frequently written primarily to gain float benefits.

Check Truncation with Electronic Collection

The institutional changes discussed thus far would increase the use of electronic payments by changing user prices to encourage substitution. Unfortunately, consumer habits and customs are subject to considerable inertia that often requires population growth and shifts in the age structure of the population to overcome substantially. Electronic payments are most likely to begin at the back office

level, banks collecting check payment funds electronically through ACH, and this is unlikely to occur until interstate banking begins in earnest.[10]

As discussed earlier, check safekeeping and interbank collection of funds by ACH together can save about $.06 per item. However, check truncation using ACH is unlikely to occur in todays' institutional environment. The payor and his bank are required to give up float benefits and the right to inspect the item and verify the signature. The structure of the banking industry makes negotiating away these benefits prohibitively expensive. With interstate banking, large correspondents may be able to internalize these externalities and reduce the negotiation costs for truncation. As discussed in Berger (1985), correspondent banks could develop a reciprocal truncation network similar to the current clearing system in Canada.

Interstate banking, by internalizing payments system externalities, could also encourage the use of consumer electronics. Large, concentrated banks could underwrite widespread POS networks, increase use of direct fees for checks and credit cards, and provide incentives to price-differentiate by payment means.

NOTES TO CHAPTER 1

1. Occasionally, checks are used for high-value transactions, as also occurs in the ACH. The classification shown in Table 1-3 is meant to be general and not cover every case that has occurred.
2. Walker (1980) estimated both a log-linear total cost equation and a cubic equation (not in logs). The log-linear version assumed that the SCE was a constant at all output levels and gave SCE = 0.26. The unlogged cubic equation gave SCE = 0.49 when evaluated at the mean of the data set.
3. The extreme disaggregation of the U.S. banking system is illustrated by noting that the largest bank only accounts for 4 percent of total domestic U.S. banking assets. The largest fourteen banks account for 25 percent of banking assets, and it takes seventy-eight banks to account for 50 percent of assets.
4. A different legal interpretation, however, may hold when paying banks return checks to payees because of insufficient funds in the payor's account. Here, Reserve Banks are providing a service at the request of the paying bank, so that both return item processing fees and float costs could in principle be assessed on the paying bank. About 1 percent of all checks written are returned unpaid; some 85 percent of the returned checks are due to insufficient funds in the payor's account.

5. In 1984 it was illegal to assess a surcharge on purchases by credit card, although a price discount to non-credit card users was not prohibited. Today, a surcharge is legal but is subject to Truth-in-Lending Act restrictions applying to finance charges and, for that reason, has been little used by merchants. In Congress, the Senate has passed a bill stipulating that price differences between users of different payment methods of up to 5 percent of the purchase price could exist without Truth-in-Lending Act restrictions. The House, however, is attempting to reinstitute the lapsed ban on surcharges. This controversy exists even though the effect on the relative prices faced by consumers would be the same with a surcharge for credit cards or a discount for other payment methods. Merchants, of course, favor the surcharge (since their advertised prices could stay the same or perhaps be lowered), while credit card issuers prefer the discount to a surcharge (since credit card users would not be as explicitly penalized, although merchants would be required to raise all prices to offset the discount—a difficult thing to do in a competitive market).
6. Normal ACH payment information contains only the identification of the paying and receiving financial institution along with the date and amount of the payment. In the CTP program additional information on the corporate paying and receiving institutions are added, such as the amount and number of different invoices for which total payment is being made and other information regarding trade credit, late delivery, and returned goods which affect the payment value.
7. Along with more than 14,000 commercial banks, there are 24,000 other types of depository institutions (savings and loan associations, mutual savings banks, and credit unions) which also participate in the payments system.
8. Mergers have historically been preferred to de novo entry—establishing new branch offices—as a means to enter new banking markets. Rhoades (1985) has shown that mergers have accounted for 72 percent of the current size of the twenty largest U.S. banking organizations. In this context, mergers between large banks are more likely than mergers between small banks or between large and small banks so bank concentration, when it does increase, can increase rapidly.
9. A nonbank bank is a bank that does not take deposits (but instead uses equity or nondeposit funds) or a bank that does not make commercial loans. Since the legal definition of a bank for purposes of the interstate banking restrictions concerns an institution that both takes deposits and makes commercial loans, institutions that do one but not the other are not subject to interstate banking restrictions as currently written. This view, however, was recently overturned in an appeals court opinion and may go to the Supreme Court for a final interpretation.
10. Although still in the discussion stage, it is possible that widespread check truncation will occur prior to interstate banking. The Federal Reserve

may begin truncating items at the Reserve Bank of last, and eventually first, deposit using the current ACH network. Such a development, coordinated with the current American Bankers Association (ABA) check truncation pilot program, would have a major impact on electronic payments since around one-half of all checks requiring external processing are currently handled by the Federal Reserve.

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