The Check Float Puzzle

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Although the last few years have seen a dramatic surge in interest in new electronic payment instruments, consumers and businesses in the United States still write checks in vast numbers. Nearly 63 billion checks were written in 1995 according to one estimate, representing 78.6 percent of all noncash payments (Committee on Payment and Settlement Systems of the central banks of the Group of Ten countries 1995). Check use has continued to expand in recent years, despite the increased use of debit cards and the automated clearinghouse; the per capita number of checks written grew at an average annual rate of 1.3 percent from 1991 to 1995. Moreover, forecasts call for check use to remain around current levels for the foreseeable future (Humphrey 1996). Because the social costs associated with the use of paper checks constitutes the majority of the real resource costs of the payment system—65.4 percent according to David Humphrey and Allen Berger (1990)—it will be important to continue to seek improvements in the efficiency of the check system in the years ahead.

The efficiency of check clearing is affected by the arrangements governing presentment and payment. These arrangements have a feature that is, for economists, puzzling. Helen writes a check to John for, say, $100. When the check is ultimately presented to Helen's bank for payment, the bank pays $100, and deducts $100 from Helen's account. What is surprising, from an economist's point of view, is that the bank pays the same amount, $100, *no matter how long it took for the check to be presented*. This implies that John's bank earns an additional day's interest by getting the check to Helen's bank one day sooner. This feature is puzzling because it is difficult to identify any significant social benefits to Helen or Helen's bank from getting a check from John's bank one day sooner; certainly nothing approaching the magnitude of one day's interest.

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Check float is the time between when a check is tendered in payment and when usable funds are made available to the payee (John in our example).[1] Because John and his bank bear the opportunity cost of foregone interest until the check is presented, they have an incentive to minimize the float. But check float provides interest income for Helen and her bank. Under current arrangements Helen and her bank implicitly reward John and his bank for reducing check float. Helen's bank stands ready to turn over their float earnings. John's bank thus has an incentive to capture those float earnings by accelerating presentment. Another way to state the puzzle is that the benefits to Helen and her bank do not seem to justify the incentive provided to John and his bank to minimize check float. For this reason I call it the "check float puzzle."

The resolution of this puzzle is of more than intellectual interest. Because collecting banks forgo interest earnings on the checks in their possession, they have a strong incentive to present them as quickly as possible in order to minimize the interest foregone. Collecting banks are motivated to incur significant real resource costs to accelerate the presentment of checks. Check processors, including the Federal Reserve Banks, routinely compare the cost of accelerating presentment to the value of the float. Checks are sorted at night and rapidly shipped across the country. But if there is little or no social benefit of accelerating the presentment of checks, then much of the real resource costs associated with check processing and transportation would represent waste from the point of view of the economy as a whole. It may be possible to alter this puzzling arrangement and improve the efficiency of the payment system.

The check float puzzle can be directly attributed to the fact that the laws and regulations governing check clearing mandate *par presentment*; the payor owes the face value of the check, no matter when the check arrives. Par presentment implies that the real present discounted value of the proceeds of clearing the check are larger the faster the check is presented. Par presentment essentially fixes the relative monetary rewards to alternative methods of clearing, taxing slower methods of clearing relative to faster methods. As with any regulation that fixes relative prices, there is the potential to distort resource allocations. In this article I argue that the distortion appears to be significant. This is only part of the story, however. There could be offsetting benefits that make par presentment a good thing. To justify current arrangements there would have to be social benefits of clearing checks quickly that payees and their banks—the ones deciding how fast to clear the check—do not take into account.

The check float puzzle is of interest to the Federal Reserve System (the Fed), both as payment system regulator and as the largest processor of checks. In the 1970s the Federal Reserve Banks established a number of Remote Check

[1] This use of the word float follows Humphrey and Berger (1990, p. 51). The reader should be aware that some writers use the term float in a narrow sense to refer to the time between when the payee is credited and the payor is debited: see, for example, Veale and Price (1994).

Processing Centers (RCPCs) around the country with the avowed goal of accelerating the presentment of checks (Board of Governors of the Federal Reserve System 1971; Board of Governors of the Federal Reserve System 1972). Critics have argued recently that Federal Reserve operations should be consolidated to take advantage of economies of scale in check sorting (Benston and Humphrey 1997). But closing down Fed offices could increase the amount of time it takes to collect some checks. Should this result be counted against the decision to close an office? More generally, when performing a cost-benefit analysis of alternative payment system arrangements, what value should be placed on changes in the speed of check collection?

Check Float

A few words about how check clearing works will be useful as background. Checks provide a simple arrangement for making payments by transferring ownership of book-entry deposits. Helen (the "payor") writes a check and gives it to John (the "payee"). John deposits the check in his bank, which then initiates clearing and settlement of the obligation. A check is a type of financial instrument or contingent claim. It entitles the person or entity named on the check, the payee, to obtain monetary assets if the check is exchanged in accordance with the governing laws and regulations. One noteworthy feature of the check is that the holder of the check is entitled to choose when the check is exchanged for monetary assets. In other words, the check represents a demandable debt.

John's bank has a number of options available for getting the check to Helen's bank for *presentment*. John's bank could present directly, transporting the check itself or by courier to Helen's bank. Alternatively, the check could be presented through a *clearinghouse* arrangement in which a group of banks exchange checks at a central location. Another option is to send the check through a *correspondent bank* that presents the check in turn to Helen's bank. Or the check could be deposited with a Federal Reserve Bank, which then presents the check to Helen's bank. These intermediary institutions could themselves send the check through further intermediaries, such as clearinghouses, other correspondent banks, or other Reserve Banks.

The length of time it takes to present a check depends on where the check is going and on how John's bank decides to get it there. First, the checks received by John's bank during the business day are sorted based on their destination. Sorting generally occurs during the early evening hours. Afterward, many checks can be presented to the paying bank overnight. A check drawn on a nearby bank might be presented directly early the next morning. A group of neighboring banks that consistently present many checks to each other might find it convenient to organize a regular check exchange or clearinghouse in which all agree to accept presentment at a central location. Checks drawn on

local clearinghouse banks can generally be presented before the next business day.

For checks drawn on other nearby banks it might be advantageous to clear via a third party, such as a check courier, a correspondent bank, or the Federal Reserve. A third-party check processor posts a deadline, usually late in the evening, by which local checks must be deposited in order to be presented the next day. Third parties also clear checks drawn on distant banks. Often such checks can be presented by the next day as well, especially checks drawn on banks located in cities with convenient transportation links. For checks drawn on remote and distant locations, however, an additional day or two may be needed to get the check where it is going. For example, a check drawn on a bank in Birmingham, Alabama, and deposited at the Federal Reserve Bank of Richmond is usually presented to the Birmingham bank in one day, while a check drawn on a bank in Selma, Alabama, is usually presented in two days.

When does John's bank collect funds from Helen's bank? If the two banks do not have an explicit agreement providing otherwise, Helen's bank is obligated to pay John's bank on the day her bank receives the check, provided it is received before the appropriate cutoff time. If the check is presented by a Federal Reserve Bank, the cutoff time is 2:00 p.m.; if anyone else presents the check, the cutoff time is 8:00 a.m. Helen's bank is obligated to pay by transfer of account balances at a Reserve Bank or in currency; in practice Reserve Bank account balances are the rule. Checks presented after the cutoff are considered presented on the following business day.

A majority of the checks in the United States are presented in time for payment the next business day. According to a recent survey by the American Bankers Association (1994), over 80 percent of local checks are presented within one business day, while only about half of nonlocal checks are presented within one business day (Table 1). Over 90 percent of the dollar volume of checks cleared through the Federal Reserve are presented within one business day.

What's the Puzzle?

The puzzle is that *the paying bank pays the same nominal amount no matter how many days it takes to clear the check.* Helen's bank pays John's bank the face value of the check whether it takes one day, two days, or two weeks to clear. To put it another way, an outstanding check does not earn interest while the check is being cleared. The implication is that clearing a check one day faster allows the presenting bank to earn an extra day's interest. The presenting bank's gain is the paying bank's loss, however; Helen's bank gives up one day's interest. Why are arrangements structured this way?

At a superficial level the answer is transparent. The presentment of checks is governed by the Uniform Commercial Code, the Federal Reserve Act, and

Table 1 Number of Days It Takes to Receive Available Funds on Checks Deposited through Banks' Check Clearing Network
Average Percentage of Item Volume

	By Bank Assets in Millions of Dollars		
	Less than $500	**$500 to $4,999**	**$5,000 or More**
Local Checks			
Up to 1 business day	83.7	85.9	93.8
2 business days	12.7	11.0	5.9
More than 2 business days	3.5	3.1	0.3
Number of banks responding	159	61	29
Nonlocal Checks			
Up to 1 business day	42.2	53.2	65.7
2 business days	40.8	31.1	24.3
More than 2 business days	17.0	15.7	10.0
Number of banks responding	159	60	26

Source: American Bankers Association (1994).

Federal Reserve regulations. In their current form, these legal restrictions require that checks presented before the relevant cutoff time be paid at par on the same day.[2] The result is that paying banks do not compensate collecting banks for the interest lost while a check clears. Legal restrictions effectively mandate that John's bank is rewarded with an extra day's interest if it clears a check one day faster. The check float puzzle is thus an artifact of legal restrictions that mandate par presentment.

A deeper puzzle remains, however. Can we identify any economic benefits to Helen and her bank from faster check clearing? Are they large enough to warrant the interest earnings captured by presenting faster? The answer, as I will argue below, appears to be *no*.

Note that it is irrelevant how Helen and her bank divide between them the additional interest earnings due to check float. The question is why Helen and her bank, taken together, would want to compensate John and his bank (or someone presenting the check on their behalf) for presenting the check early. Similarly, it is irrelevant how John and his bank divide between them

[2] Under Regulation CC, checks presented by a depository institution before 8:00 a.m. on a business day must either be paid in reserve account balances by the close of Fedwire (currently 6:00 p.m.) or returned (12 CFR 229.36(f)). Under Regulation J, checks presented by a Reserve Bank before 2:00 p.m. on a business day must be settled the same day—the exact time is determined currently by each Reserve Bank's operating circular (12 CFR 210.9(a)).

the opportunity cost of foregone interest earnings. Taken together, they have an incentive to accelerate the presentment of Helen's check.

Some Efficiency Implications of the Allocation of Check Float

The check float puzzle would be merely an intellectual curiosity if it had little or no consequences for real resource allocations. Unfortunately, it appears that the allocation of check float earnings has a substantial effect on real resource allocation.

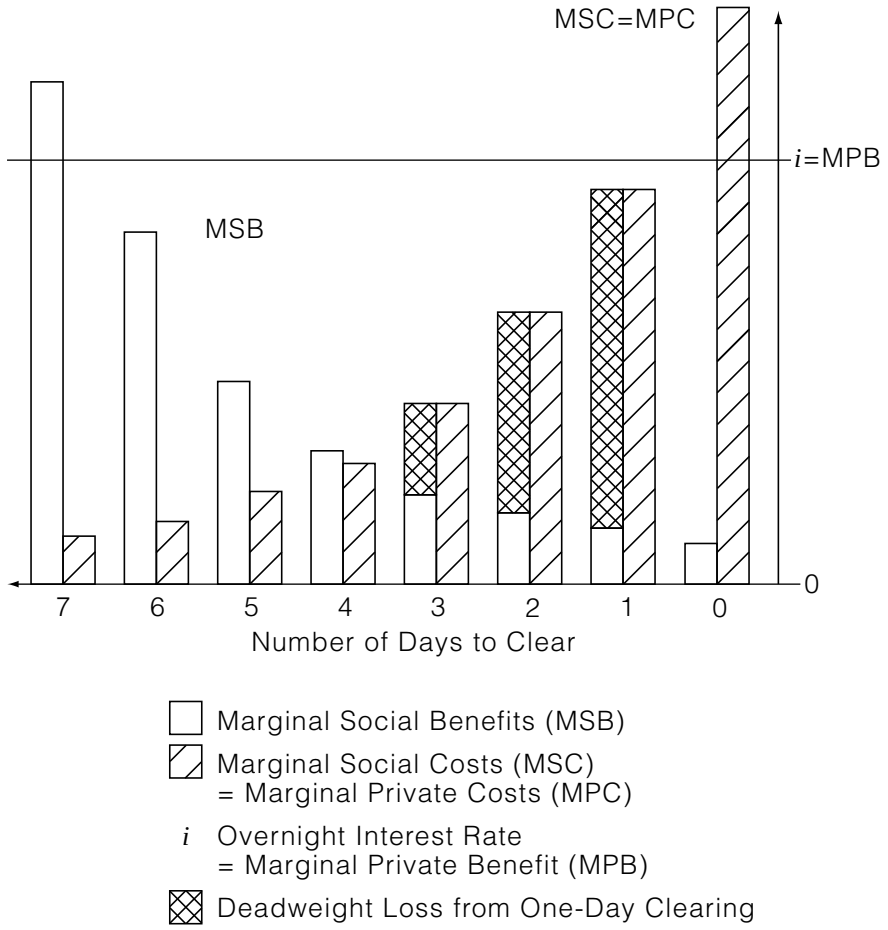
Consider the situation of John's bank, which has a range of options for clearing Helen's check. Some of these options are likely to differ in the speed with which they get the check to Helen's bank. Some clearing mechanisms might present the check in one day and some, particularly if Helen's bank is located far away, might take two or three days to present. The one-day methods have a distinct advantage for John's bank, because investable funds are obtained one day earlier. At the margin, John's bank is willing to incur real resource costs, in an amount up to one day's worth of interest earnings, in order to clear a check one day faster.

If, as I argue below, there is no identifiable social benefit of clearing a check one day faster, then the incremental resources expended to accelerate check collection and capture the interest earnings are wasted from society's point of view. The situation is illustrated in Figure 1. Check clearing speed is measured in days along the horizontal axis in Figure 1 and is increasing to the right. The position labeled "0" represents checks cleared the day they are first received, the position labeled "1" represents checks cleared one day after they are received, and so on. For a hypothetical check, the bars labeled *MPC* represent the marginal cost to the payees of clearing a check one day faster; the height for a clearing time of one day is the incremental cost of clearing in one day rather than two, the height for a clearing time of two days is the incremental cost of clearing in two days rather than three, and so on. Since these are real resource costs, they coincide with marginal social costs, so $MPC = MSC$. The marginal benefit to payees is measured by the horizontal line *MPB*; the height is the extra interest gained from earlier presentment.[3] If *MPB* exceeds *MPC*, the check is not being cleared too fast, from the payees' point of view, while if *MPC* exceeds *MPB*, the check is being cleared too fast. Payees will choose the fastest method of clearing checks that results in marginal benefits exceeding marginal costs.[4] For the checks portrayed in Figure 1, payees will

[3] I abstract from weekends, for which the extra interest would be three times as large as for weekdays.

[4] If interest compounds continuously and costs vary continuously with speed, then the payee bank would choose a method for which the marginal cost of accelerating presentment equaled the interest rate (*MB*).

Figure 1



present in one day; the marginal private cost of accelerating presentment in order to clear the same day exceeds the marginal private benefit.

I provide evidence below suggesting that the marginal social benefit of accelerating presentment is actually very small. Figure 1 therefore portrays the marginal social benefit curve *MSB* as relatively low for one-day clearing. Although the quantities in Figure 1 are not based on explicit empirical estimates, they are selected to illustrate the likely relative magnitudes involved. The socially optimal speed of check clearing in Figure 1 is four days; clearing any faster incurs marginal social costs that are greater than marginal social

benefits. The gaps between *MSC* and *MSB* between four days and one day—the cross-hatched bars—represent the deadweight social loss associated with the way check float earnings currently are allocated, as compared to a hypothetical arrangement that results in the optimal clearing time. In this sense the deadweight loss is "caused" by our existing check float arrangements.

The value of daily check float provides an upper bound on the incentive to expend resources to accelerate presentment. A rough calculation gives a sense of the potential magnitudes involved. The total value of the checks cleared in 1995 was approximately $73.5 trillion, or an average of $201 billion per day (Committee on Payment and Settlement Systems of the central banks of the Group of Ten countries 1995). The overnight interbank interest rate averaged 5.83 percent that year, which corresponds to 0.016 percent per day. Multiplying this overnight rate by the value of checks cleared yields $32.2 million per day ($201 billion times 0.000160), or $11.7 billion per year. This works out to about $0.18 per check, and represents the amount of real resource costs that would willingly be incurred by payees, like John and his bank, to present their checks one day faster. This corresponds to the height of the marginal private benefit line (*MPB*) in Figure 1. Since payee banks will ensure that *MSC* does not exceed *MPB*, it follows that *MSC* could be as large as $0.18 for the average size check. If, as I argue below, *MSB* is close to zero, then the cross-hatched bar for day 1 in Figure 1 is likely to be close to $0.18, or $11.7 billion in total. For comparison, Kirstin Wells (1996) estimates that the total cost to banks of processing and handling checks is between $0.15 and $0.43 per item.[5] If the marginal social benefits of accelerating presentment by a day are close to zero, then a substantial proportion of bank and payee processing costs could represent socially wasteful expenditures. Moreover, additional resources might be saved by clearing checks in three or more days, as illustrated in Figure 1 by the cross-hatched bars, for a time to presentment of two and three days.[6]

The prices of private package delivery services—United Parcel Service (UPS) and Federal Express—provide another rough guide to the cost of accelerating check presentment. The major services offer different delivery speeds at different prices. Assuming that prices in these relatively competitive businesses closely reflect costs, the price of overnight delivery can be compared to the price of slower delivery options to provide a crude estimate of the relative

[5] These estimates are only an upper bound on the relevant cost figures since they include the processing costs associated with receiving checks at paying banks.

[6] Note that float earnings (*MPB*) vary in proportion to the face value of the check, while costs generally do not. Marginal social benefits from reduced fraud losses are probably at least proportional to the face value of the check. Thus if payees are able to choose different clearing methods for different checks, then for large value checks the *MPB* and the *MSB* curves will be shifted upward, while the *MPC* curve will stay fixed. If it is too costly for payees to discriminate between checks, it is the average values of *MPB* and *MSB* that are relevant.

cost of overnight presentment and slower presentment.[7] The analogy between check presentment and package delivery is certainly imperfect; check presentment deadlines do not precisely match package company delivery deadlines, the items being shipped have different physical properties, and the package companies are able to track shipments in real time. Nonetheless, there are important similarities that make the comparison useful. Both use the same transportation technologies—airplanes and trucks. Both involve substantial sorting en route. And both process substantial volumes—63 billion checks annually (bundled together in packages) versus over 900 million items annually for Federal Express and 180 million items annually for UPS. In fact, both UPS and Federal Express contract with check processing firms to transport and present checks for them.

Table 2 displays sample shipping costs for UPS and Federal Express from Richmond, Virginia, to various locations. The Federal Reserve presents checks to all these locations by 2:00 p.m. the next day at the latest. For UPS letter delivery, delaying delivery by 25 $\frac{1}{2}$ hours, from 10:30 a.m. the next day to noon the second day, saves over 30 percent of the cost of next-day delivery. Delaying next-day delivery until late the second day (yielding third-day funds availability under current check presentment rules) saves about half the cost, while delaying delivery until late the third day (fourth-day funds availability) saves about 60 percent of the cost. For a one-pound package with UPS, delaying delivery to the third day saves about 70 percent of the costs. For a one-pound package sent via Federal Express, the savings are even larger. Delivery late the second day (third-day funds availability) reduces costs by almost 80 percent. These figures suggest that delaying check presentment could eliminate a substantial portion of check processing and handling costs.

Rough empirical calculations indicate, therefore, that current check float arrangements impose potentially significant social costs on the payment system. Are there offsetting social benefits?

Some Attempts to Explain the Check Float Puzzle

Eliminating Nonpar Presentment

As mentioned above, the presentment of checks is governed by legal restrictions that require that checks be paid at par on the day they are presented (see

[7] The analogy assumes that the price of delivery within a certain time frame closely approximates the average cost of delivery within that time frame. One potential weakness of this analogy is the possibility that there is a large fixed cost component and that the price differentials reflect different demand elasticities rather than different average costs. Price differentials are nonetheless limited by incremental and stand-alone costs; for either delivery option, slow or fast, the price must lie above the incremental cost and below the stand-alone cost for prices to be efficient and sustainable: see Weinberg (1994). If the demand for fast delivery is less elastic, as one might expect, then the price for slow delivery will lie close to the incremental cost of slow delivery, in which case the price differential will be no less than the difference in incremental costs.

Table 2 Shipping Rates from Richmond, Virginia
in dollars

Destination	Next day 10:30 a.m.	Second day noon	Second day close of business	Third day close of business
UPS: Letter				
Baltimore	$11.00	$ 7.50	$ 5.75	$ 4.40
Birmingham	12.50	8.00	6.25	4.90
San Francisco	13.50	9.50	7.25	5.80
UPS: One-Pound Package				
Baltimore	$14.00	$ 7.75	$ 6.25	$ 4.40
Birmingham	17.25	8.25	6.75	4.90
San Francisco	20.00	10.50	8.25	5.80

Federal Express: One-Pound Package (all locations)		
Next day 8:00 a.m.	**Second day 10:30 a.m.**	**Second day 4:30 p.m.**
$47.50	$22.50	$ 9.95

Sources: United Parcel Service (1997); Federal Express Corporation (1996).

footnote 2). Do such legal restrictions serve any efficiency-enhancing role that might justify the inefficiencies caused by excessively rapid check presentment?

The current system of presentment regulations arose over the last 90 years since the founding of the Fed. Before the Fed was established in 1914, many banks charged presentment or "exchange" fees on checks sent to them for payment. Some state laws at the time held that a check presented "over the counter" shall be paid at par, but presentment fees could be charged when the collecting bank presented by indirect means, such as by mail. The banks charging presentment fees (so-called nonpar banks) were often small and rural, and they justified their fees as a way of covering the cost of remitting funds by shipping bank notes to the collecting bank.[8]

In drafting the Federal Reserve Act, the Reserve Banks were given the power to clear and collect checks, in part to help attract members to the Federal Reserve System (Stevens 1996). While national banks were required to become members, few state-chartered banks joined the System in the early years. At

[8] The term par presentment is generally taken to refer broadly to the right to present by indirect means such as mail or courier service and still receive par.

first the Reserve Banks tried a voluntary clearing system in which they accepted at par only checks drawn on other members who agreed to accept checks at par. This scheme failed to attract enough participants and was abandoned after a year in favor of the somewhat misnamed "compulsory" system in July 1916.[9] Under the new scheme Reserve Banks accepted checks drawn on any member banks or on nonmember banks that agreed to accept checks at par. The Reserve Banks campaigned hard to get banks to agree to accept at par and had greater success. Congress helped by revising the Federal Reserve Act in 1917, adding a provision that no presentment fees could be charged against the Fed, although specifically authorizing "reasonable charges" against other presenting banks. The Reserve Banks thus acquired the unique legal privilege of being able to present at par by indirect means, such as by mail. Membership increased dramatically in the years that followed, and the Reserve Banks were successful in significantly curtailing, though not eliminating, nonpar banking. Presentment fees were effectively eliminated in 1994 when the Fed introduced regulations that mandated same-day settlement for checks presented by 8:00 a.m.

The conventional view is that par presentment regulations were instrumental in allowing the Fed to enter the check clearing business and that this enhanced the efficiency of the check collection system. If so, then eliminating inefficiencies in check collection represents a social benefit that might outweigh the social waste due to excessively fast presentment. One potential explanation of the check float puzzle, then, is that it reflects a side effect of a par presentment regime whose net social benefits are positive.

Two types of claims have been made about the efficiency-enhancing role of par presentment. The first argument, advanced by contemporary observers just after the founding of the Fed, was that presentment fees resulted in wasteful practices on the part of collecting banks seeking to avoid them. After the check is written and accepted in payment, the paying bank has a monopoly on the ability to redeem the check. Paying banks would set charges well above costs to extract rents from collecting banks (Spahr 1926). Payee banks would in turn try to avoid paying what they saw as exorbitant fees. A bank typically would have a network of correspondent banks with whom it exchanged checks. A correspondent bank would present checks directly on behalf of the sending bank or would send the check on to another correspondent, hoping it had an arrangement for direct presentment. The second correspondent might then send the check further on, and so forth. Checks sometimes traveled circuitous routes as banks sought a correspondent whom they hoped would allow them to avoid presentment charges (Cannon 1901). Such practices, it was asserted, resulted in wasteful shipping costs and inefficient delay in payment.

[9] One reason the voluntary scheme failed was the policy of crediting and debiting banks immediately when checks were received. There was a lag before banks were informed of debits, which made reserve management difficult and overdrafts frequent.

A second argument for the efficiency-enhancing role of par presentment is advanced by modern critics of the pre-Fed check collection system. Unilaterally set presentment fees allow a bank to increase retail market share by raising the costs of rival depository institutions (McAndrews and Roberds 1997; McAndrews 1995). Nonpar banking allows a "vertical price squeeze" in which a bank inefficiently raises the price of an upstream input (presentment) purchased by a bank that is a rival in a downstream market (retail deposit-taking).[10] Presentment fees are an anticompetitive practice, according to this argument, and the establishment of par presentment eliminated the associated inefficiencies.[11]

These two arguments fail to explain the check float puzzle. Regarding the first argument, it is not at all obvious that nonpar banking was inefficient. It is important to note that a collecting bank was not completely at the mercy of the paying bank. Collecting banks always had the option of finding a correspondent to present directly on their behalf, thereby avoiding the presentment fee. Competition between correspondent banks ultimately governed the cost of clearing checks drawn on distant banks and placed a ceiling on the presentment fees banks could charge. Moreover, the occasional circuitous routing of checks is not obviously inefficient, given the necessity of relying on a network of bilateral relationships (Weinberg 1997). It is a common feature of network transportation and communication arrangements; after all, the circuitous routing of telephone calls is not taken as evidence of inefficiency.

Another common feature of network arrangements is the presence of fixed costs. In such settings there typically is a range of prices consistent with efficiency and sustainability. Each participant obviously will prefer to bear as little of the fixed costs as possible. Critics of presentment fees wanted paying banks to bear more of the common costs of check clearing. Defenders of presentment fees wanted collecting banks to bear more of the costs. The par presentment controversy appears to have had more to do with distributional issues than with economic efficiency.

The view that presentment fees can facilitate a vertical price squeeze is based on models that take many important aspects of the institutional arrangements governing check clearing as fixed. Models in which such arrangements are endogenous can have very different predictions. For example, Weinberg (1997) describes a model of check clearing in which outcomes are efficient, even without restrictions on presentment fees. Such models are attractive in this setting because, historically, check clearing has often involved cooperative arrangements between banks, such as clearinghouses. Moreover, the banks most susceptible to a vertical price squeeze by the nonpar banks were located close

[10] See Salop and Scheffman (1983) for a basic exposition, and Laffont (1996) and Economides, Lopomo, and Woroch (1996) for applications to network industries.

[11] McAndrews (1995) argues that the imposition of any uniform presentment fee would suffice to eliminate this inefficiency.

by, and were the very banks that could present directly. The banks that bore the brunt of presentment fees were those located at a distance and thus least likely to lose retail customers to the paying bank.

More to the point, check clearing arrangements provided the same incentives to accelerate presentment both before and after the founding of the Fed. Under state laws and established common law principles, the presenting bank was entitled to immediate payment at par for checks presented over the counter. Thus a bank presenting directly to the paying bank faced the same relative incentives before and after the entry of the Fed into check clearing; getting the check there one day earlier resulted in one day's worth of interest. Over-the-counter presentment served as an anchor for the prices of other means of presentment. It placed a bound on the payee bank's willingness to pay an exchange fee for presenting by mail or to pay a correspondent bank for collecting the check. Neither the paying bank nor the correspondent bank had any incentive to compensate the payee bank for the interest foregone before remitting the check. Thus the relevant property of the par presentment regime predates the Fed's entry into check clearing. The elimination of nonpar presentment cannot explain the check float puzzle.

Reducing Check Fraud

Another possible explanation of the check float puzzle is that clearing checks faster reduces check fraud losses to paying banks and their customers. Helen's bank might be willing to compensate John's bank for getting the checks to them sooner because it reduces the expense associated with check fraud.

There are various ways in which banks and their customers can lose money to check fraud. Someone possessing lost or stolen checks can forge the account holder's signature or the endorsement. Checks can be altered without the account holder's approval. Counterfeit checks resemble genuine checks and can sometimes be used to obtain funds. Checks can be written on closed accounts. Fraudulent balances can be created through "kiting"—writing a check before covering funds have been deposited.

When Helen's check is presented for payment her bank can verify the signature and the authenticity of the check and can verify that the account contains sufficient funds. If her bank chooses to dishonor the check, it must initiate return of the check by midnight of the business day following the day the check was presented. The check is then returned to John's bank. If Helen's bank paid the check when it was presented, then a payment is made in the opposite direction when the check is returned. Otherwise Helen's bank returns the check without paying.

Note, however, that if Helen's bank returns the check, Helen's bank bears no loss. John and his bank now have a check that was dishonored, and between them they bear the loss (or else seek compensation from Helen). John and his

bank can be expected to take into account the effect of the speed of check clearing on the likelihood of their fraud losses. Therefore, the losses experienced by payees and their banks do *not* help explain the check float puzzle. The losses that *are* relevant to our puzzle are those borne by Helen and her bank. They would be willing to compensate John's bank to induce more rapid clearing if that helped reduce their own check fraud losses.[12]

There are a number of reasons why check fraud losses to the paying bank might be reduced if it received the check faster. Helen's bank may allow the time limit for check returns to elapse before finding out that the check is forged or that Helen has closed her account. Some banks, for example, do not routinely verify signatures. In this case, Helen's bank bears the loss. Such losses might be lower for checks presented faster. Helen's bank might want to provide an implicit reward to John's bank for rapid presentment. In principle, then, the desire to encourage rapid check clearing to discourage check fraud might explain the check float puzzle.

But is the check fraud effect large enough empirically to explain the check float puzzle? Does getting the check to Helen's bank one day faster reduce fraud losses at Helen's bank by enough to justify providing John's bank with one more day's interest on the funds? According to a recent Board of Governors report to Congress (Board of Governors 1996), check fraud losses incurred by U.S. commercial banks, thrifts, and credit unions amounted to $615.4 million in 1995. Some check fraud losses occur to banks in their role as collectors of checks drawn on other banks, and some occur to banks in their role as payors of checks drawn on other banks. Of the total estimated check fraud loss mentioned above, only about half—$310.6 million—represents losses to banks as payors. The remainder represents losses to banks as collectors. As noted above, only check fraud losses to the payor are directly relevant to the check float puzzle.

The figures just cited are *gross* losses, however. The Board study reports that depository institutions *recovered* a total of $256.0 million on past check fraud losses in 1995, although it does not indicate how these recoveries were divided between paying banks and collecting banks. If we take these as estimates of steady-state losses and recoveries, and if we assume that recoveries are the same fraction of gross losses for both collecting banks and paying banks, then paying banks experienced net check fraud losses of $181.4 million in 1995.[13] Average net check fraud losses at paying banks therefore amounted to less

[12] Figure 1 could be modified to account for the desire of John and his bank to reduce their check fraud losses. The marginal benefit from reducing their expected losses should be added to the marginal private benefit curve *MPB*. The same amount should be added to the marginal social benefit curve, *MSB*, as well, so the net distortion remains the same.

[13] Recoveries by paying banks are (50.5%) $\times$ ($256.0 million) or $129.2 million, so net losses are $310.6 million minus $129.2 million, or $181.4 million. Note that the resulting figure is conservative in the sense that if check volume is growing, then this procedure underestimates the ratio of recoveries to gross losses.

than 0.0003 cents per dollar in 1995.[14] In comparison, one day's interest on the check, at a 5.5 percent annual rate (the current overnight Fed funds rate), is worth 0.015 cents per dollar; more than 50 times as large as the average rate of net check fraud losses at paying banks.

The check fraud loss figure is the *average* net loss, however. The relevant figure is the *marginal* effect on net fraud loss of clearing a check one day faster. It could conceivably be the case that, say, the expected fraud loss on a check cleared in two days exceeds the expected loss on a check cleared in one day by 0.015 cents per dollar, the value of the float, even while the average check fraud loss is 0.0003 cents per dollar. Unfortunately, there are no figures available that would allow us to estimate directly marginal net fraud losses. However, for the average net expected loss to be as small as 0.0003 cents while the marginal loss associated with clearing a check in two days rather than one day is as large as 0.015 would require that no more than 2 percent of checks take two or more days to clear.[15] No more than 2 percent is quite implausible, however, given the figures in Table 1, which show that a substantial portion of checks take two days or more to clear. Thus, even though we do not have a direct measure of the marginal expected fraud loss associated with clearing a check one day slower, the evidence strongly suggests that fraud loss at paying banks does not explain the distribution of check float earnings.

Check writers themselves sometimes suffer losses due to check fraud. Perhaps Helen's desire to limit her own check fraud losses makes her and her bank willing to forego the extra interest earnings in order to induce more rapid clearing of her checks. There are two principal methods by which a depositor could lose money due to check fraud. One is if Helen fails to inspect periodic bank statements for forged or unauthorized checks, she can be apportioned

[14] Calculated as $181.4 million divided by $73.5 trillion (dollar value of checks written in 1995 [Committee on Payment and Settlement Systems of the central banks of the Group of Ten countries 1995]) = 0.0003.

[15] Let α_i be the fraction of checks (by value) cleared in i days, and let γ_i be the expected fraud loss on checks cleared in i days. Expected fraud loss is then $\alpha_1\gamma_1 + \alpha_2\gamma_2 + \ldots = 0.0003$. Suppose, hypothetically, that the marginal loss associated with clearing one extra day, $\gamma_{i+1} - \gamma_i$, is at least 0.015. What values of α_1 are consistent with these two assumptions? The most optimistic case, in the sense that the allowable range for α_1 is the largest, is one in which all checks clear in either one or two days, because the longer it takes to clear the larger the expected loss. As long as $\gamma_{i+1} \geq \gamma_i$, the best case is for α_i to be as small as possible for $i \geq 3$, because increasing the weights on the days with larger losses makes it harder to match the average loss figure of 0.0003. Assume therefore that $\alpha_i = 0$ for $i \geq 3$. Similarly, the most optimistic assumption to make about γ_1 is $\gamma_1 = 0$, because increasing γ_1, the expected loss on the smallest loss day, just makes it harder to match the average loss figure. Our two postulates are now $(1 - \alpha_1)\gamma_2 = 0.0003$, and $\gamma_2 \geq 0.015$, which together imply that $1 - \alpha_1 \leq (0.0003/0.015) = 0.02$.

Looked at another way, for given fractions α_i, how large can $\gamma_2 - \gamma_1$ be and still satisfy $\alpha_1\gamma_1 + \alpha_2\gamma_2 + \ldots = 0.0003$ and $\gamma_{i+1} \geq \gamma_i$? The answer is $0.0003/(1 - \alpha_1)$. From the figures in Table 1 this ranges from 0.0005 to 0.005, or 3.5 to 32.3 percent of the monetary value of one day's worth of float.

some of the loss on grounds of negligence. But the timeliness of check clearing is only marginally important in such cases, since they involve inspecting monthly bank statements.

Another method by which a depositor could lose money involves "demand drafts," one-time pre-authorized checks written by merchants or vendors after taking a depositor's bank account number over the phone. In place of the customer's signature the check is stamped "pre-approved" or "signature on file." Demand drafts are cleared the same way as conventional checks and have many legitimate uses, but they have been used in telemarketing scams. It seems unlikely that the detection and prosecution of such fraud depends significantly on the speed with which demand drafts are cleared. Most cases seem to be discovered when a depositor's bank statement is inspected. Moreover, such fraud only affects demand drafts, and these are a tiny fraction of all checks written.[16] So in neither case does fraud loss by check writers appear to be a plausible rationale for the allocation of check float earnings.

There is an additional reason to doubt that fraud losses could ever explain why the collecting bank should lose interest earnings until the check is presented. The relevant interest rate is the nominal overnight rate, and thus will vary directly with expected inflation, other things being equal. There is no reason why the additional expected fraud loss associated with clearing a check in two days rather than one should have any necessary relationship with the inflation rate. Indeed, the inefficiency caused by the fact that checks do not bear interest parallels exactly the traditional welfare cost of anticipated inflation, which is caused by the fact that currency does not bear interest. The inefficiency of currency use arises because people go to excessive lengths to avoid holding it. Similarly, check float arrangements cause banks to go to excessive lengths to avoid holding checks. In both cases the problem is that the rate of return is artificially depressed by inflation. The difference between the two is that, apart from changing the inflation rate, altering the rate of return on currency, say by paying interest, appears to be technologically difficult. In contrast, as I argue below, the technology to alter the rate of return on checks appears to be readily available.[17]

The Expedited Funds Availability Act

When an account holder deposits a check at a bank, the common banking practice is to place a "hold" on the funds for a number of days until the bank is

[16] Legitimate demand drafts probably amount to less than $1 billion a year. Jodie Bernstein, Director of the Bureau of Consumer Protection, reported one estimate that "nine of the current twenty demand draft service bureaus process approximately 38,000 demand drafts weekly, totaling over five million dollars. . . ." In other words, $250 million annually (Bernstein 1996).

[17] Reducing inflation to the socially optimal rate would accomplish the desired objective, but I take that as outside the realm of check regulatory policy.

certain that the check has cleared. The bank customer is not allowed to withdraw the funds until the hold is removed. This practice protects the bank from fraud by shifting some of the risk to the account holder. In 1987 Congress passed the Expedited Funds Availability Act (EFAA), which asked the Federal Reserve to promulgate regulations limiting the length of time banks can hold customers' funds. Maximum holds vary from one to five business days, depending on the type of check and whether or not it is a "local" item.

Legal restrictions on the duration of holds can be an incentive to accelerate check presentment. After the hold is released, the funds may be withdrawn, and the bank may suffer a loss if the check is returned unpaid. Does this explain the check float puzzle? The answer is clearly no. Congress enacted the EFAA to respond to concerns that holds were longer than were necessary to ascertain whether the check would be returned unpaid. The EFAA explicitly instructs the Federal Reserve Board to reduce the allowable time periods to the minimum consistent with allowing a bank to "reasonably expect to learn of the nonpayment of most items." The hold periods, in other words, are tailored to the speed with which checks are actually being collected, not the other way around.

The EFAA constrains the distribution of the risk of nonpayment between the payee and the payee's bank. But it does nothing to alter the incentive both parties have to take steps to reduce their joint losses from fraud. The EFAA does increase the ability of payees to perpetrate fraud on their banks and so provides an extra incentive for payee banks to accelerate presentment. If the EFAA artificially discouraged faster presentment, such discouragement might explain the need for the compensating stimulus provided by the current check float arrangement. But if anything, the EFAA heightens the incentive to accelerate presentment.

What Can Be Done?

I conclude that the social benefit of accelerating check presentment is negligible in comparison to the reward to collecting banks in the form of captured interest earnings. Apparently this feature of the check clearing system does not have an identifiable economic rationale. Without any offsetting social benefits, we are left with just the social costs described earlier.

Is there an alternative to the current arrangements governing check float? Is there a practical way to eliminate the artificial incentive to accelerate the presentment of checks? After all, it could be the case that the current scheme has deadweight social costs but is superior to all feasible alternatives. Is there a feasible alternative that does not require the deadweight social costs noted above?

Consider first what properties an ideal arrangement would possess. In an ideal arrangement the value to John's bank of presenting a check one day sooner would equal the real value to Helen and Helen's bank of receiving the check one day sooner. Fraud losses (to the payor bank) aside, John's bank should

implicitly earn interest on the check while it is being cleared. Helen's bank should implicitly pay interest to John's bank from the time at which John's bank received the check. John's bank would then face no artificial inducement to accelerate presentment. Note that John's bank still has an incentive to clear the check, since fraud losses to the payee bank are likely to increase the longer it takes to clear the check. But the magnitude of the incentive to accelerate presentment would match the social value of accelerating presentment.

Check fraud losses to the payor bank constitute an additional social value of accelerating presentment. To account for these precisely, the implicit interest rate on checks should be reduced by the marginal effect of delaying presentment on payor fraud losses, resulting in a slight penalty for delaying presentment. As noted previously, however, the marginal effect on payor bank fraud losses is likely to be quite small when compared to the interest earnings at stake. In an ideal arrangement, therefore, we should see checks in the process of collection implicitly bearing interest at close to the overnight rate.

Implementing an ideal arrangement would require revising the current par presentment regulations. One possibility is to have the paying bank pay explicit interest on the face value of the check from the date the check was originally accepted by the bank of first deposit. The interest would be paid directly to the presenting institution. The interest rate could be determined by reference to a publicly available overnight rate. Regulations would stipulate that upon presentment, the paying bank is accountable for the amount of the check plus accrued interest from the date of first deposit. The regulation would constrain only the obligations of the paying bank. If the collecting bank was presenting on behalf of some other bank, they could divide the interest between them as they see fit. Presumably each bank would receive the interest accruing while the check was in their possession. Similarly, the regulation would be silent on the division of interest between the bank of first deposit and its customer.

A second possibility is for checks to be payable at par only at a fixed maturity date—say, five business days after the check is first deposited in a bank. Checks presented before five business days would be discounted, again using a publicly available overnight interest rate as reference. After five days an outstanding check would accrue interest at the reference rate. The maturity date would determine the implicit division of revenues between paying banks and payee banks.

The main practical difficulty facing any such scheme is to record and transmit the date on which the check is first deposited. Currently, the Federal Reserve's Regulation CC requires that the bank at which the check is first deposited print on the back of the check certain information (the indorsement), including the date. This information is used mostly in the process of returning checks and is not machine-readable. Some information on a check is machine-readable, however. At some point early in the clearing process, the dollar amount is printed in magnetic ink on the bottom of the check front beside

the paying bank's routing number and the payor's bank account number. The resulting string of digits and symbols—the so-called "MICR line" at the bottom of the check—is read automatically as the check subsequently is processed. One possibility would be to expand the MICR coding format to include the date as well. Then the implicit interest obligation could be handled using the same automated techniques used to handle the face amount. Although this alternative regime would certainly involve transitional costs, the figures discussed above indicate that the potential benefits are substantial—perhaps as large as billions of dollars per year.

Note that this proposal would have the side benefit of facilitating improved contractual arrangements between banks and their customers by giving them more readily usable information on when a check was cleared. This information could be used by banks to penalize kiting if they so desired. Banks might charge check writers for the interest paid to the bank presenting a check. The arrangement would be a matter of contractual choice for banks and their customers, however, and would not affect the desirability of the proposal.

In the Meantime, There Are Some Important Implications

Until we establish a more rational scheme for allocating check float earnings, payment system policymakers apparently face a dilemma. They are often asked to contemplate changes to the payment system that would alter the speed with which some checks are cleared. One example is a proposal to close down the Fed's Remote Check Processing Centers (Benston and Humphrey 1997). This would likely slow down the collection of some checks. Another example is a proposal for electronic check presentment (ECP), which involves transmitting electronically to paying banks the encoded information on checks (Stavins 1997). In this case, checks would likely be collected somewhat faster on average.

How should such changes in check float affect the decision? One point of view (the "zero-sum view") asserts that the change in float earnings is merely a transfer. The gain realized by payees and their banks from faster presentment is exactly matched by a corresponding loss to payors and their banks. In this view, changes in float should be ignored in policy analysis. That is, in a social cost-benefit analysis, no weight should be given to changes in float. This view is in accord with the evidence cited above that the social benefit of accelerating check clearing is negligible.

The danger in this approach, however, is that payment system participants respond to the (distorted) incentives embodied in the current arrangements; consequently their reactions could be misgauged. Imagine that the Fed is considering a change that would increase check float. For example, suppose that the closure of an RCPC slowed down the collection of some deposited checks. For the checks the Fed continues to process, the slowdown would reduce the

amount of resources wasted on accelerating presentment. But it would do nothing to reduce the incentive banks have to accelerate presentment. Banks could respond by clearing directly themselves or through private service providers, rather than through the Fed, in order to minimize float. If the social cost of clearing checks outside the Fed is greater than the cost of clearing them through the Fed, then there might be no net social savings to closing down the RCPC, since the increase in private costs might outweigh the decrease in Fed costs. A cost-benefit analysis that ignored the effect of changes in float could be seriously misleading.

An alternative approach (the "empirical view") would treat the overnight interest rate as the social value of accelerating presentment, as if there is some as-yet-undiscovered social benefit of reducing check float. This approach has the advantage of aligning policy objectives with the incentives faced by private participants in the check collection industry. The danger in this approach is the risk of favoring speedy check presentment when it is not really in society's best interest. Suppose again that the Fed is considering closing an RCPC, but that no banks switch to other means of clearing checks. The increase in float would be counted against closing the facility, under the empirical view. It could turn out that, if one disregards the increased float, then the net social benefits of closing the facility are positive (due to the resources saved by clearing more slowly) but are negative when the value of the lost interest earnings to payee banks is deducted.[18] In this case, the empirical approach recommends against closing the facility even though it really should be closed. By adopting the empirical view, policymakers would be joining in the private sector's wasteful pursuit of float.

The dilemma is more apparent than real, however. Policymakers should focus on the implications for real resource costs of the proposals they are considering and should exclude the purely pecuniary impact of reallocations of check float. But they should keep in mind that although float does not reflect any direct social benefits, it does affect behavior. To the extent that reallocations of float induce behavioral changes that alter real resource use, the induced changes in resource costs must be included in any cost-benefit analysis.

Current float arrangements can be thought of as imposing a tax paid by presenting banks on checks cleared by slower methods, with the proceeds automatically passed on to payor banks. The proper treatment of a tax in cost-benefit analysis is well understood. Absent other interventions, the taxed service (slow clearing) will be undersupplied relative to the untaxed service (fast clearing) for which it is a substitute. If a public entity like the Fed is active in supplying the untaxed good, and unilaterally cuts back on its supply, providing more of

[18] The float that Reserve Banks experience is passed back to depositing banks. If, for example, 97 percent of a particular class of checks is cleared in one day and the rest in two days, on average, depositors receive 97 percent of their funds in one day and the rest in two days.

the taxed good instead, the net effect will depend on the market for the untaxed good. At one extreme, the Fed might have many competitors whose costs and prices are close to that of the Fed. In this case reducing the supply of the untaxed service merely causes customers to switch to competitors—no improvement in efficiency results. At the other extreme, if the Fed has few competitors for the supply of the untaxed service—no other suppliers have costs close to the Fed's—then customers can be induced to switch to the socially superior taxed good. Here, slowing down Fed check collection does not drive customers away, with the result that check collection does indeed slow down and thus saves societal resources. Note that this outcome could increase costs to Fed customers in the sense that Fed fees plus float costs increase, even though social costs decrease.

In the decision to close an RCPC, for example, the analysis should take into account the effect of increased float on depositing banks' check clearing choices. To the extent that increased float causes banks to switch to other providers—private check clearing services or correspondent banks, for example—the increase in the real resource costs of alternative check clearing operations should be counted against any savings in real resource costs associated with Fed check clearing. The change in float earnings itself should be excluded from the calculation of net social benefits, but the effect on bank choices must be taken into account.

In evaluating ECP, the float benefits to payees from faster presentment should not count as a social benefit, as Joanna Stavins (1997) correctly points out. If ECP is offered under current par presentment regulations, however, the benefits of float arising from faster presentment (assuming they are passed back to depositing banks, as is current Fed practice) would be an artificial stimulus to the adoption of ECP. If ECP is offered at prices that are efficient (relative to the real resource costs of ECP) and the extra float earnings from faster presentment are passed on to payees, then ECP may be adopted where it is not socially efficient.[19] For some checks ECP might be more costly than physical presentment, and yet customers would prefer ECP because of the benefits of reduced float. The Fed should avoid deploying ECP in market segments where it would increase social costs, even if it would decrease Fed customers' costs (including float costs).

More generally, the check float problem can distort the process of technological innovation by artificially promoting techniques that accelerate check presentment. Payment system participants have an incentive to find new ways

[19] ECP with check truncation is often said to involve "network effects" because such a scheme would be most valuable if universally adopted, eliminating all paper presentment. The same logic applies, however. The set of prices that are efficient and sustainable relative to resource costs alone will not in general coincide with the set of prices that are efficient relative to the aggregate of resource costs and float costs. See Weinberg (1997) regarding network effects in payment arrangements.

to reduce their holdings of non-interest-bearing assets, like currency and checks (Lacker 1996). This incentive is merely an artifact of the inflation tax, and thus does not represent any fundamental social benefit (Emmons 1996). The check float problem is another example of the way inflation can distort the payment system.

The check float puzzle has important implications for the role of the Federal Reserve in the check clearing industry. The Fed currently enjoys certain competitive advantages over private participants. One involves the disparity in presentment times mentioned above; the Fed can present until 2:00 p.m. for same-day funds, while others must present before 8:00 a.m. for same-day funds (unless varied by agreement). This disparity gives the Fed a competitive advantage, because depositors can be offered a later deposit deadline at a cost lower than that of a private provider. Having such a competitive advantage would allow the Fed, should it so desire, to improve the efficiency of check collection by slowing down presentment and increasing check float beyond that which the private market would provide.[20] It gives the Fed an ability to offset some of the deleterious side effects of par presentment regulations. Note that this outcome is the opposite of the original justification of the Fed's role in check clearing provided by opponents of presentment fees, who claimed that the Fed would result in more rapid check clearing.

The Fed's advantage over private providers of check clearing services has been eroding over time. In 1980 Congress passed the Monetary Control Act, which required that the Fed charge prices for its payment services comparable to those that would be charged by private providers. Effective in 1994, Regulation CC was amended to allow "same-day settlement"—private presentment as late as 8:00 a.m. for same-day funds. Because of these changes and other factors, the Fed's market share has been steadily eroding in recent years (Summers and Gilbert 1996). Payment system efficiency no doubt helped motivate this movement towards a "level playing field." And yet these changes have reduced

[20] To see this, consider the following simplified situation. The Fed faces private providers with costs of γ_1 of clearing a check in one day and γ_2 of clearing a check in two days. The value of one day's float on a typical item is i. Under competitive conditions the cost to a depositor is $\gamma_1 + i$ for clearing privately in one day, and $\gamma_2 + 2i$ for clearing privately in two days. Clearing in two days is socially optimal, so $\gamma_1 > \gamma_2$, there being no other relevant social costs or benefits associated with check clearing. But under the current regime checks are collected (inefficiently) in one day; that is, $\gamma_1 + i < \gamma_2 + 2i$, or $\gamma_1 - i < \gamma_2$. The Fed offers check clearing, but only two-day clearing. Suppose the Fed's cost of clearing in two days is δ_2, and the Fed charges p per item. Cost recovery requires (a) $p \geq \delta_2$. Can the Fed attract depositors that are now clearing privately in one day? This requires (b) $p + 2i < \gamma_1 + i$. Together, (a) and (b) are feasible if $\delta_2 < \gamma_1 - i < \gamma_2$. The Fed's presentment time advantage implies that the Fed can present checks in a given number of days at lower cost than the private sector can present checks in the same number of days: in other words, δ_2 is strictly less than γ_2, as required. Thus the Fed's presentment time advantage allows the Fed to reduce check clearing time from one day to two days in this example, improving the efficiency of the check collection.

the Fed's ability to unilaterally improve the efficiency of check collection by slowing down check presentment.

Now is a good time, therefore, to reexamine the Fed's role in the check collection industry and the payment system more broadly.[21] As noted earlier, the rationale for the Fed's original entry into check collection was to improve efficiency. But the par presentment regulations that once aided the Fed's entry are now clearly an impediment to efficiency. Can the Fed still play an efficiency-enhancing role in the presence of par presentment regulations? Can the Fed implement technological improvements to the payment system without removing inefficient par presentment regulations? These questions should be at the heart of any reexamination of the Fed's role in the payment system.

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[21] In October 1996 Federal Reserve Chairman Alan Greenspan appointed a committee, headed by Board Vice Chair Alice M. Rivlin, to review the Fed's role in the payment system.

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