

Are On-Line Currencies Virtual Banknotes?

STEPHEN F. QUINN AND WILLIAM ROBERDS

Quinn is an associate professor of economics at Texas Christian University. Roberds is a vice president and economist in the Atlanta Fed's research department.

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Cash is increasingly being displaced by private forms of payment. Currently the U.S. economy functions with a minimal stock of cash, probably amounting to less than 2.6 percent of its annual gross domestic product (GDP).¹ This figure is markedly less than historical estimates for the United States (for example, about 3.2 percent in 1960) or contemporary estimates for other countries (as high as 4.9 percent for some European countries, according to Humphrey 2002). Roughly three-quarters of all transactions still take place on a cash basis (Committee on the Federal Reserve in the Payments Mechanism 1998), but the average amount of a cash-based transaction is small, probably less than \$10.² When payment technologies are compared on a value basis, payments based on the transfer of “inside money” (payments by check, payment card, or direct transfer) dominate, accounting for the vast majority of the value of transactions within the United States.³

Payment in inside money is, of course, hardly a recent phenomenon. By the fourteenth century, European merchants had discovered the essential advantage of inside money: Exchange using debt ties up fewer resources than does the exchange of costly coin.⁴ Since not everyone's debt is likely to be equally reliable, however, inside-money payment systems have historically singled out the debt of a select group of “strong credits” (banks) as closer

proxies for commodity (or outside) money. These privileged forms of debt possess the moneylike property of finality—of being able to extinguish other debts by virtue of their transfer from debtor to creditor.⁵ However, the limitation of this privilege to certain strong credits also imposes constraints on those parties whose debt does not qualify as money. Hence, there has been an incentive to extend the reach of inside money with payment devices of limited finality, such as the check. Such instruments can broaden the benefits of inside money but may also increase the risk of default or fraud.

Monetary history is punctuated by innovations—deposit banking, checks, banknotes, credit cards—that have expanded the role of inside money. For example, in recent years technology has made it possible for virtually anyone with a credit or debit card to pay for any purchase (from a merchant with an account with a credit card company) anywhere with a relatively high degree of finality. In many situations, card-based payment systems have offered considerable improvements over their paper-based predecessors.⁶ A merchant selling a good to an unfamiliar customer can accept a card payment with the confidence that such payment is usually, if not completely, final.⁷ Payment by check would not offer the merchant the same degree of finality, and requiring cash payment could deny customers access to credit.

The finality associated with card payments does not extend to every transaction environment, however.

Payment cards, and especially credit cards, are often used in situations—such as mail order, telephone, and Internet transactions—in which the cardholder is not present and cannot sign a receipt. In such cases the risk of fraud is elevated, but little of this risk is borne by credit card holders because (under U.S. law at least) their liability is limited to \$50 and in practice is often zero.⁸ A credit card holder may also withhold payment if he believes he has been charged for goods or services that were not delivered or were defective. In such circumstances, offering blanket guarantees of payment finality to merchants would create an unmanageable risk for card issuers. Instead, merchants bear most of the fraud risk in the form of liability for chargebacks (debits to a mer-

Despite the obvious differences between on-line currencies and physical banknotes, they share some conspicuous similarities in the circumstances of their birth.

chant's account resulting from disputed payments) from the card issuers. This risk allocation has made "cardholder not present" credit card payment more expensive and generally less attractive to merchants unwilling to accept the risk of chargebacks. Internet transactions seem especially at risk, and this riskiness is reflected in fraud rates for on-line transactions. Trade publications have reported rates of credit card fraud as high as 2.1 percent for Web-based transactions, roughly ten times the rate for face-to-face transactions.⁹

The past few years have seen the debut of several new types of on-line payment arrangements, at least partly in response to the difficulties associated with card-based payment over the Internet. These arrangements offer the promise of making it possible for anyone to pay anyone on-line, even in situations in which card-based payment would be infeasible or uneconomical. The most innovative arrangements, sometimes referred to as on-line currencies, bypass the traditional, bank-based methods for clearing and settlement of payments in favor of a simple "on-us" funds transfer—that is, a transfer of a claim on the on-line currency issuer (in the form of an account balance) from payor to payee.¹⁰ While the finality of such transfers has thus far been of a limited nature, the most successful on-line

currency issuer, PayPal, now offers its users finality guarantees under some circumstances.

What is the future of this type of payment arrangement? To date, industry reviews have been mixed. Most observers concede that on-line currencies have offered a useful service for person-to-person on-line transactions, most typically those associated with on-line auctions. On the other hand, on-line currencies have seen relatively little use in purchases by consumers from businesses, and most of these exchanges have been restricted to small enterprises. This situation has led some analysts to believe that future use of on-line currencies will be, at best, restricted to the person-to-person niche.

This article examines the likely success or failure of on-line currencies by means of a historical analogy. Specifically, the discussion compares the introduction of on-line currencies to the debut of the bearer banknote, the direct predecessor to modern currency, in late-seventeenth-century London. Despite the obvious differences between these on-line currencies and everyday, physical banknotes, the argument presented here will show that they share some conspicuous similarities in the circumstances of their birth. In particular, the article argues that the key innovation of the earliest banknotes was to provide finality under circumstances in which extant payment systems either could not ensure final payment or could do so only at an unacceptable cost. The next section describes how on-line currencies may be able to fill the same role in the context of e-commerce. The discussion concludes with some observations about future prospects for on-line currencies, again using the (clearly successful) introduction of the banknote as a historical model.

Early Forms of Inside-Money Payment

An initial summary of the prebanknote payment system in Europe, which combined deposit banking, orders to transfer deposits, and transfer of those orders by endorsement, is helpful in explaining the innovation offered by banknotes and the potential for on-line currencies. The system began with deposit banking in Italy, where two merchants desiring to transfer funds would together visit a banker and have one account debited and the other credited. Such transfers *in banco* spared merchants the transportation, protection, assay, and opportunity costs of using coin—the outside money of the time. The banker's ledger formed a permanent record, and payment within the bank was final.

To avoid the need for both parties to visit the bank together, deposit banking developed payment by check or draft. Checks drawn on banks in early

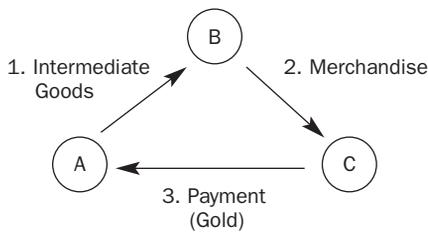
modern Europe, including the goldsmith bankers of seventeenth-century London, fulfilled a role similar to that of personal checks drawn on modern deposit banks—such checks enhanced decentralized exchange. Then, as now, the convenience of payment by check created a risk of default because payment was not final until the bank honored the check, and then, as now, whether the bank honored the check depended on the adequacy of the check drawer's account balance or the willingness of the bank to allow an overdraft. This risk was manageable, but only because checks were generally used by prominent personages and for local payments only.

To arrange the payment of funds outside the local banking system, one had to arrange for payment by bill of exchange. Much like a modern traveler's check, a bill ordered someone in a distant location to pay a fixed sum to a payee at that location. However, a bill was different from a modern traveler's check in that it was payable only after some fixed amount of time had passed. Bills of exchange were generally payable in the prevalent currency of the distant location. For a bill to work, the person who wrote the bill (the drawer) had to arrange for someone to pay the bill at the other end (the acceptor). This arrangement was

most easily made if the drawer had a close relationship with the acceptor. For example, Renaissance Italians established international family networks to act as acceptors. Later, bankers used systems of agents or correspondent banks. Once the bill had been accepted (always indicated in writing on the bill), it became a legally enforceable claim against the acceptor. Or the acceptor could refuse the bill by protesting it (and indicating so in writing on the bill) and returning it to the drawer.

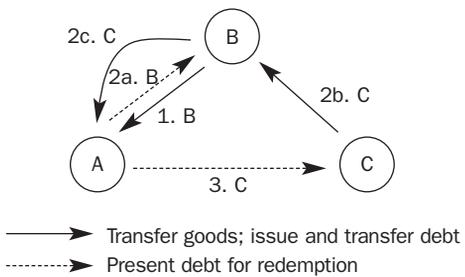
The transfer of checks, drafts, and bills of exchange extended the opportunity to use inside money beyond the immediate range of a deposit bank. Remote transfer of third-party debt had a beneficial netting effect, reducing a chain of obligations to a single obligation between the original obligor and the ultimate creditor. The benefits of remote transfer were especially pronounced for places that outlawed deposit banking, such as London and Antwerp (van der Wee 1997). Instead of checks and ledger entries, inside money in these locales had to take the form of circulating personal obligations.¹¹ A key advance in promoting extensive use of remote transfer was recognition of the legal standing of parties who had been assigned the debt

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1. As of this writing, U.S. GDP is about \$10.7 trillion. The stock of U.S. currency is about \$690 billion, but, according to estimates (see Porter and Judson 1996), at least 60 percent of this stock resides outside the United States. The 2.6 percent figure is thus calculated as 40 percent of the currency/GDP ratio. Humphrey (2002), applying similar methods, arrives at an estimate of 1.7 percent.
 2. Boeschoten (1992) estimates that the average value of a cash transaction in the United States is about \$5.
 3. "Inside money" is the term used by economists to refer to money created by the private sector, typically money in bank accounts. "Outside money" refers to money created outside the private sector, meaning currency issued by, or money held in accounts at, a central bank. This generalization about inside money holds even when large-value, interbank settlements are excluded. The Bank for International Settlements (2001) estimates that daily U.S. noncash transactions averaged \$288 billion in 1999, not counting interbank settlements. If the average cash transaction amounted to, say, \$20, this scenario would imply that the value of cash transactions makes up only 5 percent of the value of all transactions.
 4. On the early use of inside money, see, for example, De Roover (1948) for Bruges, Usher (1943) for Barcelona, and Mueller (1997) for Venice. Today inside money supplants outside (government-issued) money instead of metallic coin.
 5. Finality was a key feature of early banking arrangements. For example, De Roover (1948, 335) observes that oral transfers of bank deposits were irreversible once a transfer had been recorded in the bank's ledger.
 6. This improvement stems from the fact that credit cards have reduced both payment risks and, in many cases, costs (see Berger, Hancock, and Marquardt 1996, 700–709).
 7. Credit card companies often absorb the loss in cases in which the merchant has obtained authorization from the credit card company for the transaction and has also obtained the customer's signature. A recent study by the U.S. General Accounting Office (1997, 114) reports that the card companies' average share of losses on credit card transactions is 70 percent, with the remainder borne by the merchants.
 8. In the case of credit cards, a cardholder's liability in cases of fraud is limited by the Truth in Lending Act of 1968 (TILA). TILA also guarantees cardholders the right to withhold payment in certain instances. See, for example, Mann (1999, 107–40) for a detailed discussion of TILA and its implications.
 9. See, for example, Punch (2002) or Lee (2003). The fraud rate is typically calculated as the value of fraudulent transactions as a fraction of the value of all transactions.
 10. Many other names have been proposed for these arrangements. Two of the most common are "alternative currency" and "online payment systems." Kuttner and McAndrews (2001) employ the term "proprietary account systems" while Schreft (2002) uses "proprietary monetary value." For the limited purposes of this article, all of these terms will be considered synonymous.
 11. These obligations were either bills of exchange or personal promises to pay, then called letters obligatory and later called promissory notes.

FIGURE 1**A Bill-of-Exchange Transaction****A: Flow of Goods**

Sequence of Events

1. Supplier A transfers intermediate goods to merchant B.
2. Merchant B transfers merchandise to customer C (in return for bill).
3. Customer C honors bill and pays supplier A.

B: Flow of Debt

Sequence of Events

1. Merchant B issues debt to supplier A.
- 2a. Supplier A presents B's debt for redemption.
- 2b. Customer C issues debt (bill) to merchant B.
- 2c. Merchant B transfers C's debt to supplier A.
3. Supplier A presents C's debt for redemption.

of a third party in payment. The London Mayor's Court granted such recognition in 1436, and the concept spread to Antwerp (Munro 2000).

Even with legal recognition, the effectiveness of remote transfers without banks was limited because information was needed to assess the credibility of the debt issuer (the acceptor of a bill), and such information was often asymmetric and idiosyncratic. Transfer created an incentive to pass on high-risk or fraudulent debt. In 1507, Antwerp mitigated this problem by creating a legal obligation of contingent liability on anyone who transferred third-party debt (van der Wee 1997, 325). According to the new rule, when a payor paid in the debt of a third party, the payor was also obligated to accept liability for the debt should the original obligor (or previous transferors of the debt) be unable to settle. Contingent liability gave anyone who wanted to circulate debt a strong incentive to screen the quality of the debt he was attempting to circulate. In practice, the simplest way of recording who had transferred a debt was to have each party sign the back of the debt.¹² The institution of endorsement (transfer with contingent liability by means of a signature) spread across Europe and was applied to checks and bills of exchange. Combining legal standing with transfer by endorsement gave rise to the concept of a negotiable instrument, essentially a freely transferable debt whose possession automatically confers upon its holder well-understood rights as a creditor.¹³ Amsterdam became the dominant hub of international finance by buttressing a payment system based on the exchange of negotiable instruments with a municipal exchange bank (Dehing and 't Hart 1997).

Another distinctive feature of negotiable instruments was the idea that anyone receiving an instrument by means of endorsement became a "holder in due course."¹⁴ Essentially this concept meant that endorsees almost always enjoyed full creditor's rights, even in cases when the good that was supposed to be delivered against the original obligation was not delivered or was defective (with some exceptions for sham transactions associated with fraud schemes). This feature enhanced the "money-ness" of negotiable debt by ensuring that good-faith transfers of such debt were final, barring default of the original obligor.

A Model of Debt Transfer

Kahn and Roberds (2001) analyze debt transfer and circulation by endorsement in a formal economic model in which payment by transfer of negotiable debt results in a desirable allocation of risks among payor, payee, and outside parties. They consider a stylized example in which party A supplies an intermediate good to merchant B, who uses the intermediate good to produce a durable final good, merchandise. Merchandise is delivered to customer C in return for a promise of future payment (see Figure 1). However, C may default on the promised repayment for one of several reasons (C may change his mind about the value he places on the merchandise or may be subject to an event such as fraud). Of course, knowledge of his own propensity to change his mind is C's private information. Knowledge of the customer's susceptibility to fraud risk is also private information, but the merchant may have some better knowledge of this informa-

tion than the supplier does. All contracts between parties are subject to limited enforcement in the sense that assets held by a party defaulting on an obligation are not always attachable by creditors.

Optimal payment arrangements in this environment have two salient features. First, overly risky customers (those who have decided they do not want the merchandise or those too susceptible to credit events) should not receive merchandise. Second, in cases in which the merchandise is delivered, some portion of the promised payments by the customer should flow directly from the customer to the supplier, bypassing the merchant. In the latter case, an optimal allocation of risks can be implemented by a pair of debt contracts, one from the customer to the merchant and the other from the merchant to the supplier, as long as the merchant can discharge his debt by transferring the customer's debt to the supplier (see Figure 1B). In other words, the merchant uses the customer's debt to pay his own.

A potential problem with this type of arrangement is "adverse selection." That is, in cases when the merchant deals directly with the customer and the supplier does not, the merchant is apt to have better information about the customer's creditworthiness than is the supplier. The merchant may then have an incentive to pass on the debt of less creditworthy or nonexistent customers to the supplier. To guard against this temptation, the merchant must accept contingent liability for (endorse) the customer's debt should the customer be unable or unwilling to pay. For this endorsement to be meaningful, the merchant himself must have sufficient wealth at stake.

The intuition behind this result is straightforward. Payment by transfer of debt is desirable because it short-circuits the credit chain from customer to merchant to supplier, thereby limiting the possibilities for successive defaults. Transfer, however, creates an adverse selection problem, so adding endorsement gives the merchant an incentive to avoid transactions with overly risky customers.

Enter Banknotes

The combination of local deposit banking and circulating debt via endorsement created a suc-

cessful system of inside money for the commercial elite but left out many people. Merchants, nobles, and others with sufficient standing could pay local obligations by means of checks drawn on a local bank, but these checks were useless for trading at a distance. Prominent firms could pay obligations incurred in long-distance trade by drawing bills payable on their overseas branches, but this option was out of the question for smaller firms. Likewise, large players could introduce others' bills into circulation by endorsing them over to their creditors, but such players had to have sufficient wealth (and sufficient information regarding the creditworthiness of the acceptor) to have their endorsements valued.

The key innovation of the earliest banknotes was to provide finality under circumstances in which extant payment systems either could not ensure final payment or could do so only at an unacceptable cost.

Mengle (1990) describes payment by check (and, by extension, similar negotiable instruments) as enforcing a loss-allocation rule that obeys a least-cost avoider principle. By requiring an endorsement with every transfer, this rule assigns liability for credit risk and fraud to the party presumed able to avoid such risks at least cost—the endorser. Mengle notes that for this type of rule to be effective, the party in question (in this case, the endorser) must be able both to bear the relevant risk and to undertake actions that contain the risk. Early users of negotiable instruments understood these limitations and restricted the use of such instruments accordingly.

To serve those excluded from the endorsement system, bankers in mid-seventeenth-century London developed a niche product that became the banknote.¹⁵ Deposit banks finally appeared in London with the loosening of economic controls by Oliver Cromwell in the 1650s. Unlike in Amsterdam,

12. Originally, endorsements were always made to a specific party. There were no "endorsements in blank" such as those commonly entered on the back of a modern check.
13. The technical definition of negotiability is somewhat involved. For a discussion, see, for example, Winn (1998). Negotiability, while largely irrelevant for electronic payments, remains the basis for U.S. law pertaining to checks.
14. See, for example, Winn (1998) for a discussion. The notion of a holder in due course exists even in contemporary payment law but is of limited relevance in most situations.
15. Banknotelike instruments had seen sporadic use before this time. DeRosa (2001), for example, documents the issue of banknotes by Neapolitan public banks in the sixteenth century, although these notes generally circulated only by endorsement. The focus here is on the early London banknotes as the most direct predecessors of the modern, bearer banknote.

private banks in London were free to develop, and they rapidly did by offering services such as deposit accounts, money changing, lending, discounting, and international payments (Richards 1929, 23–24). The system was tied together by mutual acceptance with bilateral clearing, and some bankers even became key government financiers and tax collectors (Quinn 1997). Under this system, a customer who lacked enough personal renown to write a check could pay with a draft drawn by a banker on himself (somewhat analogous to a modern cashier's check). The practice of banks issuing drafts was a small step from the personal pledges common to English commercial practice.

Combining legal standing with transfer by endorsement gave rise to the concept of a negotiable instrument, essentially a freely transferable debt whose possession automatically confers upon its holder well-understood rights as a creditor.

The banker's note could then circulate by endorsement, but a signature added little value because people did not need to screen the banker within the local payment system. Since information about default was symmetrical (between payor and payee), the endorsement neither revealed information nor reduced any moral hazard. The benefit of an endorsement to the endorsee was essentially the same as the cost of the contingent liability to the endorser, so the situation had no least-cost avoider. Moreover, if carrying out the legal claims created by the contingent liability created unrecoverable costs such as time and legal fees, then endorsement could even become undesirable. The alternative was to allow for transfer without endorsement by making the banker's note payable to bearer. The combination of a banker's draft with the payable-to-bearer feature effectively achieved finality without having to wait for a draft to return for settlement by the issuing banker. Customers who needed bank-issued debt for payment purposes could easily prefer the bearer form, and this form of transfer created no additional cost for the banker.¹⁶

In the context of the Kahn-Roberds model, issue of one of these early banknotes can be interpreted as a sort of debt swap (see Figure 2). The earlier example is augmented by the addition of an agent known as the banker, who is informed with respect

to the risk of party C. The banker has no access to productive technology but has an income that is verifiable by all parties. Merchant B swaps the debt of C, seen by B's supplier (A) as too risky, for the bearer debt issued by banker E. All parties gain from this transaction: A views E's debt as trustworthy and is therefore willing to supply B with an intermediate good in return for it. C is able to obtain merchandise in return for an uncertain promise of future repayment, and E is able to profit from his knowledge of C's creditworthiness and from his own verifiable wealth.¹⁷

A key characteristic of this arrangement, vis-à-vis earlier arrangements, was the transfer of risks in the payment process to the banker who issued the bearer note (though the other parties still bore the risk that the banker's note could be counterfeit). Specifically, if a bearer note was issued against a bill that was fraudulent or simply not repaid, the banker could have borne the loss. This risk allocation could again be described as obeying a least-cost avoider principle, only with the role of the least-cost avoider played by an outside party (the banker, party E) and not by a principal in the chain of transactions (an endorser, party B).

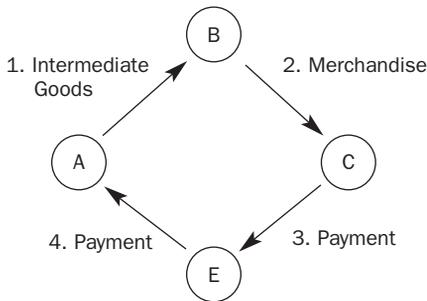
Bearer notes especially suited customers who were not well known and who did not have a local bank account but who did have an asset to offer. An example would be an unknown foreign merchant (or his agent) who had a bill drawn on someone most London merchants did not know. If the banker had an informational advantage because of his wide network of dealings, then the banker could buy the bill at a discount in exchange for a bearer banknote. The merchant received a local means of payment with finality, and the banker profited from his expertise. Bearer banknotes were a financial innovation that extended the immediacy of settlement beyond walking distance from a banker's ledger.

The earliest extant ledgers of a London banker, those of Edward Backwell, confirm the modest beginnings of banknotes. Backwell was a member of the first cohort of goldsmiths to open deposit banks in London sometime in the 1650s. According to his earliest surviving ledger, in 1663 Backwell was already a full-service deposit banker. Backwell was a prominent banker, one who was even mentioned in Samuel Pepys's famous diary, because he invested heavily in government debt and managed the tax farm that collected the customs. He was ruined by the government's default in 1672. His records from 1663 through 1671 survived because his heirs married into the Childs banking family, whose bank of the same name still operates on Fleet Street.

FIGURE 2

A Banknote Transaction

A: Flow of Goods

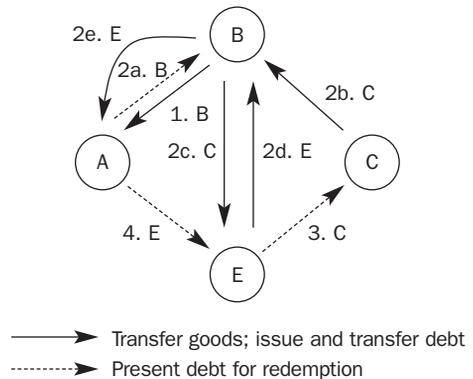


Sequence of Events

1. Supplier A transfers intermediate goods to merchant B.
2. Merchant B transfers merchandise to customer C in return for C's debt, which is transferred to banker E.
3. Customer C pays debt to banker E.
4. Banker E pays debt to supplier A.

Note: Events 3 and 4 may occur in reverse order.

B: Flow of Debt



Sequence of Events

1. Merchant B issues debt to supplier A.
- 2a. Supplier A presents B's debt for redemption.
- 2b. Customer C issues debt (bill) to merchant B.
- 2c. Merchant B transfers C's debt to banker E.
- 2d. Banknote issued by banker E to merchant B.
- 2e. Merchant B discharges debt to supplier A by transferring banknote.
3. Banker E presents customer C's debt for redemption.
4. Supplier A presents E's banknote.

In 1668 Backwell began a small business issuing bearer notes separate from any demand account (Royal Bank of Scotland, *Backwell's Ledger Q*, folio 274). Depositors with Backwell may have been accepting bearer notes even earlier; unfortunately, the ledgers do not explain how depositors withdrew their funds. The “bearer” account, however, explicitly records the creation of bearer banknotes outside of a deposit account. From 1668 to 1671 he issued sixteen such bearer notes with an average value of £174, a tiny sum given the size of his bank. Over the same period, for example, Backwell paid customers a total of £75,000 in interest alone.¹⁸ The banknotes circulated for only a few days. The exception was one experimental note, which circulated for ninety-two days, but this situation was made possible only by offering a 6.5 percent annual

interest rate on the note. Available evidence thus suggests that the issuance of banknotes began as a side business. The profitability of the notes lay not in their circulation but most likely in their ability to “credit enhance” other forms of debt, that is, to be accepted in exchange for discounted debt drawn on other parties.

The banknote, however, was a scalable product. The prerequisites were recognized standing in the local community, an ability to assume the credit risk associated with discounting debt, and a well-informed position in the asset market. In 1694, just twenty-five years after Backwell's experimentation, the newly founded Bank of England was purchasing assets with banknotes on a massive scale. The Bank of England was a chartered joint-stock company with a subscription of £1.2 million. It had only a tiny

16. The bearer feature of such debt left no record of transactions. But the absence of such a record did not really place additional limits on the recourse of parties using such debt against seller-side fraud relative to the use of instruments that were payable to order. In the latter case, a seller would have been a holder in due course and fully entitled to enforce the debt against the original obligor (the banker).

17. The banker could also simply pay coin for C's debt. But to do so would entail an opportunity cost, namely, the cost of liquidating another asset in order to obtain the coin.

18. See Royal Bank of Scotland, *Backwell's Ledger*. For bearer notes, see *Ledger Q*, folio 274; *Ledger R*, folio 296; *Ledger S*, folio 335; and *Ledger T*, folio 83. For interest, see *Ledger Q*, folios 111, 421, 481, 521, 612, 621, 631–35; *Ledger R*, folios 121, 421, 599, 601–9; *Ledger S*, folios 141, 421, 582, 612, 630–38; and *Ledger T*, folios 61, 321, 451, 591, 612–21.

deposit business, yet by 1696 the Bank of England had issued £800,000 in banknotes (Horsefield 1983, 24). Unlike the earliest banknotes, which were most likely issued against commercial bills of exchange, the Bank of England's notes were used to acquire large amounts of government debt. The Bank of England did discount bills of exchange, but discounted bills were never a major asset on the Bank of England's balance sheet until the Napoleonic Wars, a century after the bank's founding.

The issue of such an outsized quantity of notes was essentially a solution to a chicken-and-egg problem. In contrast to earlier banknotes, Bank of England notes commonly remained in circulation

The initial advantage of banknotes was their ability to provide payment finality in situations in which existing payment institutions could not efficiently do so.

even when they bore no interest. There was a network effect present in large-scale note issue in the sense that the liquidity of the notes (the willingness of counterparties to accept the notes as payment) grew as they became more widely held. The profitability of the notes grew as their liquidity increased because people were willing to hold the notes for their liquidity value and less likely to present them for redemption. Thus, a large-scale issue was needed for the notes' liquidity while liquidity was required to sustain large-scale issue. To benefit from these network effects, the Bank of England needed to execute a sizable initial swap of notes for debt. The government, with its large financing needs, provided an ideal counterparty for such a swap.¹⁹

By issuing bearer notes in such large quantity, the Bank of England also effected a qualitative change in the character of the notes. Rather than functioning as credit-enhanced versions of other, unmarketable obligations, banknotes were seen as general claims backed by the assets of the bank, which by and large consisted of government securities. Bearer notes were thus transformed from a niche product to a viable competitor for coin and bills as a medium of exchange.

The issue of banknotes became common practice in Anglo-American banking. Scotland established a system of corporate, note-issuing banks beginning

with the Bank of Scotland in 1695 (Checkland 1975, 23–90; White 1984, 22–34). In the following century, discounting of bills of exchange with banknotes became the dominant means of finance for English banks outside of London (Pressnell 1956, 136–89). Banknote finance also dominated U.S. banks until the Civil War.²⁰

Not all early, large-scale note issues were successful, and the issue of banknotes contributed directly to the famous twin financial debacles of 1720: the Mississippi Bubble in France and the South Sea Bubble in London. In both cases, banknotes were issued well beyond the value of government debt that the issuers actually held (Neal 1991, 62–117). The collapse of the Mississippi Bubble soured the French on note-issue banking for the remainder of the Old Regime. The collapse of the South Sea Company in London left the Bank of England the only corporate bank in England for over a century.²¹

Nor did bearer notes ever completely supplant coin, especially for small-value transactions. Banknotes were originally conceived as wholesale or business-to-business products, and this was their predominant use throughout their early history. Banknotes were typically issued in large denominations only. Small-denomination bearer notes were legally prohibited on the grounds that they were subject to moral hazard problems (Smith [1776] 1994, 351–52) or, worse, a potential hazard to the maintenance of a precious-metal standard.²²

To summarize, bearer banknotes were an innovation in the payment system that began by serving a very small niche market. The initial advantage of banknotes was their ability to provide payment finality in situations in which existing payment institutions could not efficiently do so. The Bank of England was able to scale up this idea by pairing the public's liquidity demand with the government's considerable financing needs. The resulting arrangement went on to redefine the notion of money and to revolutionize government finance.

On-Line Payments

The Internet has accelerated the demand for inside money payments that do not involve face-to-face contact. Of the traditional payment technologies, credit cards have been the payment mode of choice for on-line transactions.²³ However, as noted earlier in this article, the finality of card-based payments over the Internet is rather less than in face-to-face transactions. While card issuers bear some of the credit risk associated with on-line transactions, on-line merchants bear most of the fraud risk.

The lack of finality in card-based on-line transactions places today's on-line merchants in a position somewhat comparable to that of merchants doing business in early modern Europe.²⁴ As was the case with the early merchants, today's on-line merchants often have little choice but to accept risky debt in payment. When a customer offers on-line payment via a credit card, the merchant can receive value for that payment only by negotiation and endorsement (in the sense of transferal with acceptance of conditional liability) of the customer's debt to other parties involved in the clearing of credit card payments.²⁵

To place the on-line merchants' situation in the context of the model depicted in Figure 1, let B represent a merchant doing business on-line with a customer, C. Party A represents an amalgam of upstream parties with whom the merchant must deal in order to do business, including suppliers, merchant acquirers, card associations, and card issuers.²⁶ In taking an on-line card-based payment, the merchant is in effect taking the debt of the cardholder with the expectation that it can be transferred for value. Current rules concerning chargebacks limit the finality of such transfers, however, and require that the merchant be willing to accept liability for chargebacks. While the merchant is nominally protected from credit risk, there is still some risk of a chargeback if a cardholder simply withholds payment, claiming to be a victim of fraud.²⁷ And, the merchant bears the loss if fraud actually occurs.²⁸

Admittedly, even at this level of abstraction the analogy between the circulation of negotiable debt

and the processing of on-line card payments is an imperfect one. The clearing of card payments differs from true negotiation in the sense that an on-line merchant can receive value only through a prespecified clearing process and is not free to transfer receipts to any third party she may choose. Also, consumer protection clauses of the Truth in Lending Act keep upstream parties in the clearing process (most notably, the card issuer) from acting as holders in due course of the consumer's debt, that is, enforcing the debt in cases of fraudulent or disputed transactions. Nonetheless, the most characteristic feature of transactions with negotiable instruments—the allocation of credit or fraud risk to the merchant—is shared by on-line transactions using credit cards.

As was the case with the endorsement of circulating bills of exchange, this risk allocation can be defended as a reasonable trade-off between the merchants' need for an on-line payment medium and the credit card issuers' need to contain the risks associated with on-line transactions. According to the least-cost avoider principle, such an allocation makes sense as long as (1) the merchant has some informational advantage over upstream parties in dealing with her customers and (2) the merchant has sufficient wealth at stake to make her endorsement of the customers' debt a meaningful action. These two requirements may be reasonable ones for large on-line retailers but are less likely to be valid for smaller businesses or individuals.²⁹ And in some instances—for example, in international transactions—even large retailers are reluctant to accept on-line credit card payments.

19. In principle, the Bank of England could have bought the debt of parties other than the government. But the government, as the largest potential debtor, was arguably the best choice for an initial issue of notes.

20. See Bodenhorn (2000). New England was an exception; see Lameroux (1994).

21. At the time, incorporation of a bank required an act of Parliament. The reluctance of Parliament to allow the incorporation of additional banks was no doubt in part motivated by the efficiency of the Bank of England as an engine of government finance.

22. See, for example, Timberlake's (1978) discussion of small-denomination banknotes in the late-nineteenth-century United States.

23. A survey cited in *The Economist* (2001) puts credit cards' share of on-line transactions at 95 percent.

24. Throughout this section the term "on-line merchant" may refer to anyone selling, or wishing to sell, a good or service over the Internet.

25. These parties might include the merchant's bank, a "merchant acquirer" that processes the payment, a credit card company that sets the rules for clearing and settlement of card payments, and the institution that issued the card used to make the payment.

26. In other words, for expositional purposes, assume that the merchant is dealing with a zaibatsu that provides him with supplies, trade credit, and card payment services.

27. This phenomenon is especially prevalent with on-line gambling and adult entertainment services, where it goes by the name of "friendly fraud."

28. Of course, the merchant also has the option of simply not shipping the good until the payment becomes final. For example, an on-line merchant may demand a check payment and wait until the check arrives and clears before shipping merchandise. But this practice may result in a costly and unacceptable delay.

29. Recently a number of firms have begun to offer fraud-detection services for on-line retailers; see, for example, Richmond (2003). These services have no doubt decreased the cost of detecting on-line frauds, but their cost may still be too high for some low-volume on-line merchants.

The existence of would-be on-line purveyors who are unwilling or unable to accept the risks associated with card-based on-line payment has created a demand for alternative payment arrangements. This need has been especially strong for on-line auction sites, where many of the merchants are either households or low-volume retailers. A number of business models have attempted to fill this on-line payment niche.³⁰ To date, the most successful has been the “on-line currency” arrangement, which offers payment by on-line transfer of a debt claim on a private party. The remainder of this section focuses on the design of the most widely used on-line currency, PayPal, bearing in mind that some of its features might be shared by other on-line currency arrangements.³¹

The most characteristic feature of transactions with negotiable instruments—the allocation of credit or fraud risk to the merchant—is shared by on-line transactions using credit cards.

PayPal works much like an early deposit bank.³² Deposits are made by transfer of funds to PayPal either by credit card or through electronic funds transfer (debit of the depositor’s bank account through the automated clearinghouse [ACH]). Any PayPal account holder can transfer funds to anyone with an e-mail address: both transacting parties are in effect electronically brought to PayPal, and the transfer is made *in banco*. A payer (who has deposited sufficient funds in his account or who has a sufficient line of credit with his credit card company) initiates a payment by visiting the PayPal Web site and typing in the name and address of the payee. The payee receives an e-mail informing him of the payment and has several methods by which he can access the transferred funds. These include (1) circulation, meaning use of the funds received to make additional on-line payments; (2) transfer of funds to the payee’s bank account via an ACH credit transfer or by check; or (3) access through an automated teller machine debit card (issued by a bank affiliated with PayPal).

The finality of the on-line transfers is not automatic. First, since deposits to an on-line account are payments made by credit card or through electronic funds transfer (ACH debit), the finality of these transfers falls under the relevant laws and regulations for such transfers.³³ Accordingly, these trans-

fers may be reversed in cases of fraud, or, for credit cards, in cases in which the cardholder authorized the transaction but claims the goods delivered were nonexistent or otherwise defective. The losses from these chargebacks must then be shared between the merchant and PayPal. Unless there is a prior agreement with the merchant (one such agreement is described below), PayPal must attempt to recover the loss from the merchant. Second, according to its IPO filing, PayPal considers transfers on its own books as subject to the Electronic Funds Transfer Act and Regulation E. Under these rules, the liability of account holders is limited in cases of unauthorized transactions, and such limitations can lead to reversals of funds transfers and attempts to recover losses from the payee (merchant).

However, PayPal does provide some assurances of payment finality in cases in which a transaction is covered by its seller-protection policy. Among the requirements are the following:

- The seller has been verified as legitimate.
- Goods are shipped to a verified buyer’s address.
- The seller can provide proof that the goods in question have been shipped (intangible goods are therefore not eligible).
- Only one payment has been accepted for the goods in question.
- The goods are shipped to a U.S. buyer at a U.S. address.

If these conditions are met, PayPal assumes risk from unauthorized and false claims of nonshipment of up to \$5,000 per year in return for a small fixed fee plus a percentage of each transaction.

Formally, this type of transaction can be thought of as involving the debt swap depicted in Figure 2. The on-line merchant, B, trades the risky obligation of the buyer, C, for the less risky obligation issued by an on-line currency provider, E. The on-line currency provider benefits by charging the merchant a fee on (in other words, by discounting) the transaction but also ends up bearing a good portion of the fraud risk. Hence, for this arrangement to work, the provider must have sufficiently good information on the legitimacy of the buyer.

Do on-line currency providers have access to such information? In the case of PayPal, fraud-loss figures reported in connection with its IPO filing (U.S. Securities and Exchange Commission 2001, 26) indicate that such losses amounted to 0.87 percent of total payment volume in the year 2000 and 0.41 percent of payment volume in the first six months of 2001. These figures compare unfavorably with fraud

rates for traditional payment systems (0.2 percent or less) but are reasonably close to reported figures for on-line credit card fraud (which range from about 0.5 percent to higher than 2 percent). According to press reports (for example, Stone 2001), PayPal's user-verification procedure has been instrumental in containing fraud. This procedure involves depositing small, random amounts of funds in each user's bank account and requiring the user to correctly report the amounts deposited.³⁴

Numerous articles in the popular and trade press have documented that on-line currency arrangements have become extremely popular for certain types of on-line payments, most notably for on-line auction sites such as eBay.³⁵ For such transactions, the appeal of on-line currencies is understandable, particularly in cases where a finality guarantee is provided. In effect, such a system offers a seller in on-line auctions the same "insurance" service that Edward Backwell offered merchants in seventeenth-century London. That is, the idea behind on-line currency provision is to profit from swapping payor obligations for the obligations of the currency provider—in other words, from guaranteeing the transfer of discounted buyers' claims to sellers.

As was the case with early banknotes, the revenue stream from providing an on-line currency is principally derived from discounting—from transactions fees—rather than from collecting interest on funds circulating as on-line balances. For example, in the second quarter of 2001, PayPal had revenues of \$19.9 million, with \$18.6 million, or 94 percent, derived from transactions fees. In other words, there is little evidence so far that people are using on-line currencies for any purpose other than one-time, on-line purchases.

Caveats

The discussion above has laid out one possible explanation for the popularity of on-line cur-

rencies—their ability to provide finality in on-line transactions. Kuttner and McAndrews (2001) and Schreft (2002) lay out some alternative explanations for the popularity of on-line currency payments. First among these is convenience. Since payments can be made by e-mail, there is no need for a household or very low-volume merchant to set up a merchant account to receive on-line currency payments. For higher-volume merchants, however, the opposite consideration may hold true; that is, the merchant may prefer to consolidate all on-line payments through a single payment processor, usually a firm that processes credit card payments.

Price may be another significant factor behind the use of on-line currencies. To date, on-line currency payments have typically been free (or close to it) for individuals and merchants with low transaction volumes. For these people, accepting on-line currency payments is simply cheaper than accepting credit card payments. For slightly higher transaction volumes, however, transaction fees are charged, and published merchant per-transaction fees for PayPal are roughly comparable to those posted for on-line credit card payments. This detail suggests that other factors determine merchants' decisions about which types of payments to accept. These factors could include the effort and expense of maintaining a merchant account for receiving credit card payments. But for many low-volume merchants, finality considerations may be the most important factor: For small operations, just a few significant losses due to on-line fraud could easily negate the benefits of a lower transaction fee.³⁶

While the finality rationale for the provision of on-line currencies closely mimics that of the earliest banknotes, some marked differences in the function and implementation of the two sets of arrangements are also apparent. Chief among these differences is that, to date, on-line currencies have been

30. Kuttner and McAndrews (2001) and Schreft (2002) survey various modes of on-line payment.

31. PayPal, which was launched in 1999, was recently (October 2002) acquired by the on-line auction company eBay. Basic information on PayPal is available from the prospectus filed for its initial public offering (IPO) (U.S. Securities and Exchange Commission 2001) and from its Web site, www.paypal.com.

32. As of this writing, however, PayPal does not offer traditional checking accounts and is not legally recognized as a bank. PayPal is considered a "money transmitter" under the laws of many states.

33. These laws and regulations include but are not necessarily limited to the Truth in Lending Act/Federal Reserve Regulation Z for credit card payments and the Electronic Funds Transfer Act/Federal Reserve Regulation E for funds transfers.

34. PayPal has applied for a patent on this procedure, but, in the meantime, other providers of on-line payment services may be using it.

35. See, for example, Sapsford and Beckett (2001) or Slatalla (2001). Wingfield and Sapsford (2002) report that 70 percent of electronic transactions over eBay are PayPal transactions.

36. This view is consistent with press reports concerning the hazards confronting small businesses or households selling on-line. See, for example, Richmond (2003).

used primarily for relatively small-value transactions.³⁷ The cost of managing the risks associated with these transactions is high relative to the value of payments transferred, and whether these costs can be kept within reasonable limits over the longer haul is an open question. On-line currency providers have moved aggressively to contain fraud risk—by implementing the verification procedures described above, by placing limits on transaction balances, employing pattern-recognition programs to detect fraud, and freezing accounts suspected of fraudulent activity. Such aggressive strategies can easily backfire, however, by undermining confidence in the very service that the currency providers are attempting to sell—that is, payment finality.

The need to conduct transactions with strangers over the Internet has created a demand for new payment technologies, as did the need to conduct transactions over distance with strangers three hundred years ago.

A related issue is the degree of finality that is appropriate for small-value on-line transactions. Payment finality insulates the seller from the risk of fraud on the buyer side but also creates an incentive for the seller to provide substandard merchandise or simply no merchandise at all. Compared to the wholesale payment environment that spawned the first banknotes (where one might reasonably expect all parties to have been well informed about the risks involved and reasonably capable of bearing these risks), in an on-line environment, providing buyers with some degree of recourse or insurance against fraudulent sales may be desirable for transactions involving consumers. At least one on-line currency provider (PayPal) insures buyers to a limited extent against fraud, but such insurance is again likely to raise the cost of providing the on-line currency.

Another fundamental distinction between the on-line currencies and the early banknotes is that, thus far, on-line currencies have been provided by stand-alone enterprises only tangentially connected to mainstream banking and payment industries. No bank, card association, or other payment-card issuer has offered an on-line currency up to now. On-line currency providers have thus been unable to take advantage of potential economies of scope in managing information about their customers.³⁸

On-Line Currencies: Prospects

What is the future of on-line currencies? Certainly the on-line currency business model has achieved a measure of success in its role as payment provider for on-line person-to-person and consumer-to-small-business transactions. But even within this niche, on-line currency providers face competition from other payment technologies. An important question is whether on-line currencies will be supplanted by these other technologies in person-to-person applications.

One source of competition is bank-affiliated on-line payment systems such as c2it (operated by Citibank). These bank-sponsored systems essentially function as facilitators for traditional payment systems, allowing on-line buyers to send funds either by credit card or ACH debit to on-line sellers. While the bank-sponsored systems do not offer finality guarantees (beyond the guarantees of the underlying payment mechanism), their affiliation with banks confers some potentially important advantages in the provision of payment services. These advantages include automatic access to existing payment and settlement systems, extensive information on the banks' own customers, a widespread physical infrastructure, and a wealth of human capital in managing risks associated with small-value payments. And since banks are regulated institutions, consumers may feel that payment services associated with banks are safer and more likely to be cooperative in resolving disputes even if the full extent of the safety net of bank regulation may not extend to banks' associated on-line payment systems.

Credit card companies are also trying to lower fraud risk in on-line payments, for example, by making use of software that generates credit card numbers that can be used for only a single on-line purchase. Credit card holders can use one of these single-use card numbers without having to reveal the number of their physical credit card, thereby lessening the chance that their card number will be put to fraudulent use. More recently, credit card companies have introduced on-line authentication systems (see, for example, Punch 2002) in an attempt to control on-line fraud. Merchants who use these systems require would-be on-line purchasers to first obtain a unique password from their credit card company. The purchaser must then enter the password before using his credit card to make the on-line purchase. The use of these systems and other technological improvements in credit card payments may eventually result in more widespread acceptance of credit cards by low-volume on-line retailers and hence less demand for payment by on-line currency.

TABLE

Parallels in the Development of Banknotes and On-Line Currencies

	Circa 1700	Circa 2000
Problem: Arranging transactions between strangers	Transactions must be made over distance	Transactions must be made over the Internet
Solution: Third-party instruments (merchant transfers the debt of a customer to pay off existing debt)	Bills of exchange (merchant transfers the debt of a customer by "drawing a bill" on him)	Credit cards (merchant transfers a consumer's credit card payment)
Problem: Adverse selection ("lemons") problem of low-quality payments driving out high-quality payments	Bills are forged or drawn on poor credits	Credit card fraud
Solution: Merchant signals quality of debt by accepting contingent liability	A merchant must endorse a bill before transferring it	A merchant must accept chargeback liability for on-line credit card payments
Problem: Contingent liability excludes some merchants	The value of an endorsement depends on reputation and collateral	The cost of chargeback liability is too high for some low-volume merchants
Solution: Third-party supply of liability	A London goldsmith discounts a bill of exchange and in return issues a bearer note or banknote	An on-line currency issuer accepts a credit card payment and creates a claim that can be transferred on-line
Opportunity: Expand innovation beyond niche market	Bank of England buys a large issue of government debt and issues many banknotes; these come into general circulation	?

A more fundamental question, and one even more difficult to answer, is whether on-line currencies will break out of the on-line person-to-person niche and become a widely accepted substitute for more traditional forms of payment such as checks and currency. The volume of payments made through on-line payment providers remains relatively small, probably below 500,000 per day according to Kuttner and McAndrews (2001), as compared to more than 200 million payments made daily through traditional payment instruments. Just as users of early banknotes did, on-line currency issuers face a chicken-and-egg problem: liquidity (and hence profitability from circulation) is linked to the scale of the currency issue, and, conversely, the scale is linked to liquidity. No doubt the demand for on-line currencies has been limited by the inconvenience of converting traditional forms of inside money (bank deposits) to an on-line currency and vice versa. Demand for on-line currencies could be enhanced if people could receive

an on-line currency payment with the expectation that the currency could be passed on without having to convert it into traditional bank money. To date, no on-line currency provider has been successful in creating such an expectation.

Conclusion

This article has argued that there are certain parallels between the current on-line payment environment, which led to the development of on-line currencies, and the physical payment environment of roughly three hundred years ago, which led to the debut of banknotes. These parallels are summarized in the table.

The first parallel is in the emergence of a demand for new payment technologies. The need to conduct transactions with strangers over the Internet has created such a demand, as did the need to conduct transactions over distance with strangers three hundred years ago. In response to this demand,

37. For the second quarter of 2001, PayPal reported that 85 percent of its transactions were below \$1,000 and that the average transaction value was about \$50. See U.S. Securities and Exchange Commission (2001, 1).

38. However, the on-line verification system used by PayPal and some other on-line payment providers (discussed above) does in effect free ride on information gathered by banks concerning their customers.

payment providers in both cases established new payment technologies—on-line credit card payments now and negotiable bills then.

The second parallel is in the problem of adverse selection in these new types of payments, particularly over the risk of fraud on the buyer side of the transactions. The solution, in both the current and historical cases, has been to provide limited finality and concentrate fraud risk on sellers (through credit card chargebacks now and endorsement then) who accept payments that use the new types of payment technologies.

The third parallel derives from the fact that this last risk allocation is not always the most desirable one for all transactions. Households and low-volume merchants in particular may be unable or unwilling to bear the risk of buyer-side fraud. The solution has been to create a new type of payment technology that

allocates much of the buyer-side fraud risk to an outside party—on-line currency providers now, goldsmith issuers of banknotes then.

Despite these evident parallels, we would stop short of calling on-line currencies “virtual banknotes,” at least for the time being. This hesitance exists because the final step in on-line currencies’ “monetization”—widespread acceptance as a circulating medium of exchange—has yet to occur. It remains to be seen whether an on-line currency issuer will overcome the financial and technical, not to mention legal and regulatory, hurdles associated with scaling up its on-line currency into a viable competitor to traditional payment media. Whether such a feat—comparable to the Bank of England’s initial banknote issue—is possible in today’s world is, at best, debatable. But if monetary history is any guide, the resulting payoff would be large.

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