

**Mengerian Perspectives on
The Future of Money**

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Menger's Project and Ours

Carl Menger (1909) offered a logical evolutionary account or “rational reconstruction” of the development of money out of barter. He explained how money had emerged incrementally and spontaneously from individuals’ efforts to economize on their costs of achieving desired trades. Here we use Mengerian analysis to envision *future* developments in the payments system.

Menger had to rationally reconstruct the origins of commodity money because the events he wanted to explain took place prehistorically, before written evidence. His theory is consistent with the anthropological and experimental evidence we do have. Just as importantly, the theory is grounded in the behavior of decentralized, self-interested, and modestly informed individuals. These features favor Menger’s theory over theories that imagine money to be the creature of general equilibrium, central design, or heroic invention.

In “The Evolution of a Free Banking System” (Selgin and White 1987) we offered a logical evolutionary account of an unregulated payments system, using Menger’s account of the evolution of commodity money as our starting point. We argued that, absent legal restrictions, private banknotes and transferable deposits would largely displace full-bodied coins and bullion (except in interbank payments), but the underlying specie standard would persist. Market forces would *not* promote the spontaneous emergence of a monopoly bank of issue or a fiat money.

In extending Menger's analysis to address past developments in banking, we could refer to historical evidence. We had to use rational reconstruction, however, to disentangle spontaneous developments from the results of government interference. The evolution of an idealized *free* banking system is only approximated by the history of any actual banking system.

Projecting the development of the payments system into the future poses new challenges in addition to those faced by Menger and by our earlier paper. The historical record helps insofar as we extrapolate historical trends, but the value of simple extrapolation is doubtful. The future development of the payments system will depend on future entrepreneurial innovations that can neither be extrapolated nor predicted in detail (without implying implausibly that we know where unexploited profit opportunities lie waiting). Our predictions must also be conditioned by assumptions about the future role of government in the payments system. An invisible-hand Mengerian explanation will be relevant to future developments only to the extent that governments choose (or are compelled) to allow spontaneous market processes to operate.

The Rise and Fall of Monetary Nationalism

When Menger wrote, the payments system of most countries remained largely the products of market processes. Commodity standards prevailed. Private commercial banks issued the currency notes in everyday use. Clearing and settlement, having grown from agreements between pairs of banks into system-wide arrangements, remained in the private sector. National governments were largely limited to producing coins – an

ancient role that had become less important with the advent of bank-issued money – and to regulating the private commercial banking industry.

The century that followed Menger’s essay saw governments sharply expand their involvement in monetary affairs, and might in retrospect be dubbed the “era of monetary nationalism.”¹ National governments monopolized the issue of bank notes and thereby created national central banks, suspended the gold convertibility of their notes and thereby substituted fiat monies for commodity base monies, and instituted exchange controls ostensibly to protect the value of their fiat monies. Market institutions were forced into a smaller role in the payments system.

Today, monetary nationalism appears to be waning. Driven by technological and ideological change, the market has begun to re-emerge as a major ordering force for both bank-issued money and base money.

In banking, several factors are contributing to the resurgence of market forces. The ideological current that has promoted deregulation and privatization of other industries around the globe – the growing acceptance of market liberalism – operates as well in banking and finance. Most importantly, ongoing advances in information-processing and communications technology bring financial-market innovations that progressively erode legal restrictions on banks. The process of financial markets eroding restrictions is not new: since the late 1950s the growth of the “offshore” banking market (once known as the “Eurodollar” market) has allowed at least large players to bypass anti-competitive domestic restrictions on deposit interest rates. Since the mid-1970s the development of money-market mutual funds has done the same for small savers. Today

¹ We borrow the term “monetary nationalism” from Hayek (1937).

the computerization of “sweep” accounts is rendering reserve requirements (where reserves earn subcompetitive rates) unenforceable. Banking by phone, fax, and internet is making geographic restrictions on banks increasingly less effective. As the price of remote access to offshore banking services falls toward zero, depositors both large and small can, ever more cheaply, avoid *all* kinds of inefficient restrictions on banks. To prevent the banking business they regulate from moving abroad, domestic regulators must abandon inefficient restrictions: interest rate ceilings, geographic limits, reserve requirements, lending quotas and other portfolio restraints, binding capital requirements, and mispriced deposit insurance.²

For the moment, governments face little direct competition from domestic banks in the issue of hand-to-hand currency. But emerging “smart card” systems like Mastercard’s Mondex have the potential to return the issue of currency to the private banking sector. Mondex card balances are functionally private banknotes: they are redeemable bearer claims that (unlike Visa Cash or GeldKarte balances) can circulate from card to card without passing through the clearing system.

Because trade and technology are making it increasingly easy for transactors to switch currencies, nation-states are losing their local monopoly powers in supplying base money. The trend is especially evident in smaller and poorer nations with weak currencies. As Benjamin J. Cohen (1998) has emphasized, the world is moving away from the pattern of one monetary standard per nation-state. Nations around the world have undergone unofficial “dollarization” as their citizens switch their savings and even their transactions balances to US dollars from weak domestic currencies. Several nations

² Edward J. Kane (1987) provides an early analysis of “the regulatory dialectic” between

have conceded their monetary independence by tying the domestic money to the dollar or the euro through a “currency board” arrangement. In September 2000 the government of Ecuador abolished its domestic currency unit and adopted the US dollar outright as the official currency.³ The emerging pattern recalls classical and medieval arrangements in which silver and gold were international monetary standards, and respected large-value coins circulated beyond national borders.

The fiscal (profit) motive that originally led ancient and medieval sovereigns to impose national monopolies in money production (see Selgin and White 1999) has not disappeared. But with citizens finding it increasingly easy to acquire and use stronger foreign currency, governments can no longer so effectively exploit its domestic currency as source of revenue. Some may even discover that imposing the inflation tax on domestic currency is no longer worthwhile, especially if inflation seriously diminishes its real revenue from other taxes. By officially dollarizing, the government of Ecuador bowed to the market, and adopted the currency that the country’s private sector had already adopted. In general, the further opening of currency choice in all nations points toward a world of fewer monetary standards. Much as in the Mengerian convergence from many to few commodity media of exchange, the more widely accepted and more trusted fiat currencies will increase their global market shares.

Though the main impetus for change has been technological, opinion among academics and policy-makers has also moved in the last twenty-five years toward supporting the reduction of government’s involvement in money and banking. At the

technology and financial regulation in a competitive international arena.

edge of this opinion movement has been a flourishing of research on monetary laissez-faire that Friedman and Schwartz (1986) have attributed to the influence of rational expectations, public choice, and modern Austrian economics, all of which emphasize the fundamental importance of monetary regimes. (If they are correct about the third of these influences, then Carl Menger's work on money has itself played at least an indirect role in fostering the developments that we are using it for analyzing.) Elsewhere (Selgin and White 1994) we have surveyed recent laissez-faire monetary thought. Closer to the mainstream of professional opinion, numerous economists have provided persuasive evidence that particular banking regulations are inefficient and destabilizing, both in developed countries (for an overview of US evidence see Benston 1991) and in developing countries (see Fry 1988).

In what follows we will argue that there are good reasons for expecting governments to remove the remaining significant legal restrictions on money and banking, and we will envision the implications for the future development of the payments system. We begin with the implications for the monetary standard.

Should we Expect Private Monetary Standards?

Drawing inspiration from Hayek (1978), some writers (e.g. Macintosh 1998) suggest that competitive monetary innovation will lead to the emergence of new private monetary standards, i.e. base monies and accounting units distinct from the fiat monies that central banks currently administer. We find such scenarios implausible. Mengerian

³ For a brief account of Ecuador's experience see "Ecuador Drifts Between Opportunity and Deadlock," *The Economist*, 21 Dec. 2000. On the rationale for dollarization see LeBaron and McCulloch (2000).

theory and historical experience indicate that, while commodity money evolved spontaneously from barter, the same forces of convergence (or network effects) that drove that evolution strongly favor an established money over any would-be alternative. A new money initially lacks a critical mass of users, and that fact itself discourages people from using it. Even if the incumbent is a fiat money and the newcomer is a commodity money, spontaneous switching is not to be expected unless the incumbent currency standard is expected to be highly unstable.⁴ Outside of such hyperinflationary economies, where the incumbent currency becomes so bad that we do see spontaneous “dollarization,” there is too little incentive to go first in switching to a novel standard. A switch to some kind of commodity standard will therefore not happen spontaneously (absent hyperinflation). It would require a public debate and a coordinated public decision, much like a decision to switch the side of the road on which we will all drive.

Another group of writers (e.g. Browne and Cronin 1995, Dowd 1998, Rahn 1999), drawing inspiration from the “New Monetary Economics” of Fama (1980) and others, suggest that financial innovation will lead to the emergence of a moneyless world relying on a kind of sophisticated barter. Base monies will disappear, and a “pure accounting system of exchange” will prevail, potentially using units of any arbitrary standardized commodity or commodity bundle as the unit of account. We find such scenarios equally implausible. Mengerian analysis implies that, notwithstanding financial innovation, monetary exchange will continue to pose lower transactions costs than barter and thus will persist (on this see Krueger 2000), and that accounting units will

⁴ A private entrepreneur is currently marketing a silver-backed currency in the United States. Chief among the obstacles to its widespread acceptance is that banks won’t take it (White 2000).

continue to be linked to actual base money or media of redemption (White 1984).

Network effects work against the emergence of new commodity units of account “separated” from any base money, notwithstanding the fact that such units may represent more stable standards of value.

Writers who imagine that market forces will deliver the *best imaginable* or an *ideal* standard of value seem to be engaged in utopian thinking. They wishfully think that most money users, despite being habituated to an inherited monetary standard, will know and demand the standard that would be best for macroeconomic stability. (We note that these writers themselves disagree about what that ideal standard is.) With network effects, however, the result of individuals’ pursuit of self-interest does not necessarily produce the monetary standard that a benevolent economist or social planner would select for society as a whole. Menger was well aware of this. From barter, the convergence process can select a commodity that ranks first in suitability as a medium of exchange but less than first as a standard of value. Once a monetary standard has been selected, network effects make that standard difficult to dislodge without coercion, especially by an imagined money with no base of current users.

Although it is unlikely that market forces alone will give rise to brand-new monetary standards, so long as at least one existing standard is tolerably stable, a wider scope for choice among existing currencies will influence future monetary standards as already noted. People opting for more trustworthy currency will break the link between monetary standards and nation-states, reducing the number of nations administering their own standards, and reducing the number of distinct standards in the world. Monetary denationalization and monetary consolidation will go hand in hand.

The Future of Retail Payments

Government central banks issue currency today not because they have outcompeted private firms at attracting loyal customers but because they have outlawed private competition. Legislation from the eighteenth through twentieth centuries increasingly restricted private note-issue and finally gave central banks a monopoly of note-issue.⁵ Today, private firms are introducing non-paper substitutes for central bank currency in the form of smart cards and other electronic media for conveying digital currency balances. If the new media are not legally repressed, and can exceed the convenience or interest yield (and match the anonymity) of paper money, they may eventually lead to a substantial reduction in the real demand for government currency.

The familiar types of electronic payment today are not currency-like but are forms of deposit transfer. Wire transfer has for many years accounted for the vast majority of the volume of payments (by value) in advanced economies, because it is how large-value payments are made in financial markets. (Paper currency is the most common payment method by number of transactions per day, but the average value per transaction is small.) In recent years the introduction of retail (or “point-of-sale”) electronic funds transfer, using a “debit card” and phone line to access the spender’s bank account, has brought the key features of wiring money down the level of the retail transaction. Like a wire transfer but unlike a paper check payment, retail electronic funds transfer is paperless, fully remote (neither spender nor recipient need convey any paper to the bank), and

⁵ For the historical developments in several nations, see Smith (1990). In the United States commercial banks today can supposedly issue notes, owing to the elimination of

bounce-proof (the seller phones the bank for payment verification before finalizing the sale).⁶ Automated clearinghouse payments, “direct deposit” of paychecks, and bill-paying by personal computer have the same advantages. The most obvious result of these technologies is a reduction (at least *ceteris paribus*) in the frequency of writing paper checks.

A different type of electronic payment – digital currency – is now on the horizon. (Accordingly we below call paper notes and coins “analog currency.”) Software called an “electronic purse” holds a specific amount of money, encoded as a string of digits. The purse may be stored on a “smart” plastic card with an implanted microchip, or on a personal computer hard drive. Like a traveler’s check or a private banknote, a bank-issued digital currency balance is not base money or legal tender. It is a claim on a bank or other financial institution that is denominated in and redeemable for base money or legal tender.

Like an analog currency payment, but unlike a deposit transfer, a digital currency payment does not require the spender to have a bank account. For a \$10 purchase, a card-reading device subtracts \$10 from the card’s balance and adds \$10 to the balance stored in the memory of the seller’s terminal or recipient card. A card’s balance can be increased by purchasing or borrowing balances from an issuing bank, or by placing the card in an automatic teller machine and transferring funds from a bank account, or (under the Mondex card system) by receiving funds from another card. A balance stored on a

legal restrictions in 1976 and 1994. But it is doubtful whether the Federal Reserve would tolerate any attempt by a commercial bank to take advantage of this regulatory loophole.

⁶ A “check card” (e.g. EuroCheque or Visa Check) skips the phone call, and substitutes the bank’s guarantee (vouched for by the card) that the payment will be good at the end of the day.

personal computer can similarly be increased by getting on-line with the issuing bank, or by receiving a payment through electronic mail or other internet transfer.

In contrast to analog currency, digital currency is easy to carry even in large amounts. It avoids the need to carry the correct coins for parking or public transportation. It reduces the vulnerability of vending machines to theft. It eliminates the need to count notes and coins or wait for change at a retail checkout. In an increasingly fast-paced world, a store with faster-moving lines offers shoppers an increasingly attractive advantage over its competitors. The acceptor must, however, have special hardware that analog currency does not require. In contrast to a debit or credit card, a currency card does not require the recipient to make a phone call before payment. In contrast to a check card, it does not require the acceptor to make a phone call at the end of the day, or even to have a phone line.

Currency smartcards themselves are fairly cheap to produce, and consumer reluctance to carrying yet another card can be overcome by putting the purse-carrying microchip on a card the consumer would carry anyway, such as a debit or check card. The chief barrier to the spread of currency-card payments is the cost of the hardware for accepting the cards.⁷ Will many retailers anticipate enough additional sales (or retention of sales that would otherwise have gone elsewhere) to justify the incremental cost of attaching currency-card readers to their sales registers? Will many consumers have enough occasions for receiving card-to-card payments to invest in and carry “digital wallets”?

⁷ Relatively expensive hardware is necessary to address bank concerns about security and consumer concerns about anonymity. Cheaper hardware would exacerbate these other obstacles.

The best evidence on the prospects for digital currency comes from world's largest installed smartcard base today, Germany's GeldKarte system developed by the commercial banks' industry association (the Zentraler Kreditausschuss or ZKA). Germans carry an estimated 60 million GeldKarte-capable cards, mostly microchip-equipped EuroCheque cards issued in the last few years. Transactions volume is still small compared to cash and check use. Universal use has not been immediate, because many retailers naturally hesitate to invest in card-reading terminals before many of their customers ask to pay by currency card, and many customers wait to see more retail terminals before they switch to customarily using the cards. At present GeldKarte use appears to have caught on in parking garages and a few other uses, but it remains to be seen whether its use will widen to achieve a self-feeding growth trajectory.⁸

The forces of global convergence are at work in smartcard systems. Europay (owned by MasterCard) has made an agreement with the ZKA to integrate GeldKarte into Europay's electronic purse product Clip, thus promising at least trans-European acceptance of GeldKarte balances in years to come. Ironically arriving almost simultaneously with the final stages of European currency unification, the trans-European acceptance of currency cards will eliminate the hassle and expense of changing analog currencies at the border, which was one of the leading rationales for undertaking the expenses and risks of unification. The technology for securely loading the GeldKarte via the internet, using a home computer and a relatively inexpensive peripheral device, exists

⁸ See the press accounts linked at <http://csecmc1.vub.ac.be/cfec/geldkarte.htm>.

in prototype and may soon be generally available. Paying by internet should not be far off.⁹

The German experience suggests that the adoption of currency cards will be slow, but it should be noted that in important ways the GeldKarte is not a true currency card. When a user loads a GeldKarte with balances from her bank account (recall that the GeldKarte chip is typically on a personal check card), the bank simultaneously creates a “shadow account balance” in her name against which card payments are reconciled. Alice cannot pay Bob by transferring funds directly to Bob’s card. Bob must deposit the funds before respending them. His deposit of the funds presents a claim (via the interbank clearing system) to Alice’s bank for reconciliation and settlement. The balance on Alice’s card (or in an internet-transferable electronic purse that shares this feature) is consequently more like a digital cashier’s check than like a banknote that can circulate indefinitely before redemption.

MasterCard’s Mondex system (which has undergone prototype testing in several English and American cities, but has not yet proven popular with consumers), by contrast, allows repeated card-to-card transfers. Like analog currency, Mondex card balances are bearer media, not linked to personal bank accounts. The balance-issuing institution need only know the total of its outstanding currency-card liabilities, not who holds them at any moment.

For reasons we don’t fully understand, Mondex is currently structured so that only one bank is the “originator” of card balances in any given currency unit. All Mondex card balances denominated in US dollars, for example, are to be liabilities of the Chase

⁹On the integration of the GeldKarte with the Internet see

Manhattan Bank. MasterCard might do better to allow competition among its members in issuing card balances, as the GeldKarte system does. At present, the system will not spread if Chase Manhattan lacks courage or imagination in marketing the card. MasterCard could instead give all its members the incentive to launch their own promotional schemes by letting them all originate card balances.

Because of the shadow-account system, the cards that perform both EuroCheque and GeldKarte functions do not – unlike analog currency – preserve the user’s financial privacy. The lack of privacy may be a serious disadvantage to attracting users away from analog currency. There is reportedly an “account-free” version of the GeldKarte that does preserve privacy, a card that can be purchased with cash and that is not linked to a personal bank account.¹⁰ But such cards are inconvenient to acquire and reload. Privacy is technically feasible in downloadable currency cards. It could be provided by clearing card payments only against the issuing institution’s general account. If personal information is omitted from the balance transfer message (unlike current practice in debit- and credit-card transactions), the bearer can remain as anonymous as if paying in paper banknotes.

The incentive for banks to issue digital currency is clear: float. If digital currency balances pay zero interest, as analog currency traditionally has, the bank receives an interest-free loan from customers holding its card balances. Conceivably, personal computers and smartcard devices could be programmed to pay interest on digital currency balances, augmenting the balance by a specified percentage of each day’s

www.kuk.net/geldkarte/produkte/projekt.htm.

¹⁰Internet literature on GeldKarte mentions such a card, but its actual use in Germany appears to be practically unknown.

recorded remaining balance since the last transaction.¹¹ If such programming can be developed and cheaply copied to PCs and smartcard readers or loaders, and no regulation or effective cartel agreement blocks it, competition will force the banks that issue digital currency to pay interest on digital currency. The rate will presumably be close to the rate on transferable deposits, leaving the bank with a spread just sufficient to cover its administration costs. Small-denomination currency would then bear interest for the first time in history.

The payment of interest on digital currency, combined with convenience and the desired degree of anonymity, would enhance the prospect of the public's turning away from government-issued analog currency. If interest remains too costly to deliver, however, the banks issuing digital currency will find it efficient to compete entirely on non-interest dimensions, the most important of which is presumably providing convenience in loading and spending.

Paper banknotes might be more efficient (have lower unit costs for providing the same services) than smartcard currency today (Lacker 1996). We won't know unless governments allow competitive banks to issue paper notes as well as currency cards. Where legal barriers against private paper banknotes exist, digital currency media provide an "end run" around the barrier. If nominal interest rates are high enough, float profits can enable private firms to issue digital currency and displace some analog government currency despite the higher unit costs of digital currency media. Absent actual or

¹¹ A *very* cleverly programmed card would hold digital currency balances from multiple issuers, but would spend balances issued by other banks ahead of the card issuer's, so as to maximize the issuer's float.

anticipated legal restrictions against paper banknotes, however, there is no reason for less efficient media of exchange to prevail (White and Boudreaux 2000).

Should technical progress progressively lower the relative price of the hardware needed to accept currency smartcard payments, smartcard acceptance will become more common. It is already common for photocopy machines to be equipped with card readers in addition to, or instead of, slots for coins and paper notes. (Smartcards differ from existing prepaid photocopy cards in that a microchip can carry more information than a magnetic stripe, and in that they aim to be accepted much more generally.) The set of sellers who do not accept digital currency, because their transaction volume is too small to justify an investment in the hardware, will shrink. If the set of analog currency transactions falls below critical mass, and consumers no longer routinely carry analog currency, the use of bills and coins could practically disappear, much as the use of the smallest-denomination coins has practically disappeared in many countries.

If the public does come to replace its holdings of central bank notes almost entirely with digital currency balances, there are fiscal implications: the central bank will be losing the float (or seigniorage) that it currently enjoys from holders of its non-interest-bearing currency. The competing commercial banks are not the recipients of a corresponding windfall, however; the public is. If the banks pay interest to holders of digital currency, the public's gain is obvious. If the banks do not pay explicit interest, but instead focus entirely on providing customers with desired in-kind benefits (which we could call "in-kind interest"), the public's gain is equally real. Where interest competition is legally permitted, non-interest competition will prevail only to the extent that, per unit of bank expenditure, it delivers in-kind benefits that customers find at least

as attractive as explicit interest net of the cost of collecting interest. With either price (explicit interest) or non-price (in-kind interest) competition, banks' potential float profits are distributed to the public (White and Boudreaux 2000).

Suppose that analog currency does disappear from common circulation. This does not usher in “the end of money,” as some enthusiasts (e.g. Rahn 1999) have suggested. Rather, it merely undoes the current government monopoly of currency. It returns us to a world where not only check payments but also the money used in small transactions is privately issued, as it was before the monopolization of note-issue by central banks. Digital currency payments and electronic deposit transfers are no less *money* payments than are analog currency payments and paper check transfers. Bank-issued payment media continue to be claims to an ultimate money of redemption or base money.

Base money today consists of irredeemable (fiat) “liabilities” of the central bank and Treasury. They come in two forms: currency notes and coins, and deposit balances on the books of the central bank (which commercial banks own and use for paying one another). Eliminating coins and central bank notes – by the public voluntarily swapping its holdings with banks in exchange for bank-issued card balances or deposits – would not eliminate banks' deposit balances. In fact the nominal stock of base money would not change, as banks would swap the central bank notes turned in by the public for central bank deposit balances that are still useful for settling net flows of funds between banks. Settlement balances at the central bank would then constitute the entire stock of base money.

The transition from analog government currency to digital (or analog) private currency therefore does not change the monetary standard. The base money remains a

fiat money, and bank-issued money remains a redeemable claim to that fiat money. The disappearance of central bank notes could make the unanchored nature of fiat money more obvious to the public, but a change in the standard will not automatically follow. Despite the optimism of some visionaries and promoters (e.g. www.e-gold.com) that internet payments could mean the spontaneous re-emergence of a gold standard or the emergence of some novel commodity standard, internet sellers will still want to be paid in fiat-money-denominated balances that most of their trading partners currently accept.

Bank Reserves, Interbank Settlement, and Wholesale Payments

As we have seen, the general course of payments system evolution is one in which private financial firms seek to encourage transactors to employ their IOUs (whether paper, plastic, or electronic) in place of base money. We can imagine the limiting case where the non-bank public holds zero base money. Even in that case, however, total demand for base money would not go to zero because banks and other issuers would continue to hold base money as a reserve medium.

Today banks hold base-money reserves partly to meet minimum statutory requirements. Economists have come to understand that reserve requirements are not needed either to ensure banking-system liquidity or to avoid over-supply of private money. Instead, they now view statutory reserve requirements primarily as a distortionary tax on banks. Monetary authorities, responding to this perspective (and to international competition), have become increasingly willing to abandon statutory reserve requirements altogether (e.g. the Bank of Canada), or to render them practically

irrelevant.¹² Some (e.g. the European Central Bank) have begun paying interest on reserves to reduce the distortion, or are considering doing so. So long as central banks are self-financing, such interest payments must fall short of interest earnings on underlying central bank assets, so that an opportunity cost of holding reserves will remain. Global competitive pressures will therefore promote the abolition of statutory reserve requirements, even if central banks attempt to mitigate the pressures by paying positive (but subcompetitive) interest on reserves.

Even if holding reserves continues to be costly, the abolition of reserve requirements does not imply that banks will reduce their reserves to zero. Banks will continue to have a prudential demand to hold base money reserves so long as base money remains the preferred medium of redemption and interbank settlement, that is, the asset banks typically use to pay off their claims to depositors and to one another. Bank B acquires a claim on Bank A whenever a customer transfers money (by check, wire, debit card, or other device) from his Bank A account in favor of a recipient's account at Bank B. Bank A makes good on the claim by transferring base money to Bank B.

Banks prefer to receive settlement in base money rather than financial claims, and are likely to continue to do so, for two main reasons. First, base money never confronts its recipient with a bid-ask spread or turnaround cost in acquiring and then spending it. It does not have bid and ask prices in terms of, but instead defines, the unit of account. Second, a base money payment is "final": its recipient faces no credit risk. Banks will continue to want an asset with those properties for interbank settlements.

¹² On the distortionary effects of reserve requirements, and Canada's recent phasing out of its reserve requirements, see Clinton (1997). On the historical use of reserve requirements as a tax in the United States see McCarthy (1984).

Banks will of course continue (as in the past) to seek ways to economize on their costly holdings of settlement media. The most important historical innovation in this respect was the development of multilateral clearing and settlement. Individual payment orders (whether paper checks or electronic transfers) are processed through a central clearinghouse, which calculates net credits and debits resulting from all gross transactions, typically on a daily basis. A bank then makes or receives one payment, via the clearinghouse, to settle with all its clearing partners simultaneously. Multilateral clearing (or “netting”) allows a huge volume of transactions in bank-issued money to be settled with a small quantity of base money. It has therefore long been the preferred settlement method of private banks. In our earlier paper (Selgin and White 1987), we discussed the spontaneous origins of private clearinghouses – institutions to facilitate economical clearing and settlement – during the 19th century.

Multilateral clearing and settlement was first organized by private market institutions, and private clearinghouses are still responsible for the clearing and settlement of a substantial volume of payments in many nations. But governments substantially increased their role in the organization of interbank payments during the 20th century. With the rise of central banks, enjoying a government guarantee against failure and a legal monopoly in issuing paper currency, private banks began to use central bank liabilities instead of base money (gold or silver) as a reserve and settlement medium. This practice was voluntary and convenient so long as central banks honored their pledges to redeem their notes and deposits in the precious metals. It was rendered obligatory when those pledges were dishonored. The advent of fiat money elevated central bank liabilities to the status of final settlement media, but did not by itself imply

nationalization of the clearing and settlement process. In some countries (for example the United States) central banks did take over the clearing and settlement functions formerly run by private clearinghouses, but elsewhere (for example Canada) private clearinghouses continued to operate. Even where they were nationalized, clearinghouses continued to practice multilateral clearing and settlement, and to allow the reserve economies associated with that practice, at least with regard to small check payments.

Today central banks that provide clearing and settlement of retail payments are finding it increasingly difficult to compete on a level playing field with private clearinghouses. They are also finding it difficult to maintain the legal restrictions and subsidies (often implicit) that used to give them an advantage. The Federal Reserve, for one, recently explored (but ultimately decided against) the option of getting out of the check-clearing business.¹³ We imagine that, in the not-too-distant future, the processing of retail payments will once again be fully privatized in all countries with well-developed banking systems. Privatization will end the implicit taxes and subsidies typically associated with state-administered clearings, and will thereby encourage greater efficiency in retail payments. For example, users of paper checks will have to bear the full costs of paper transactions, which will encourage them to embrace electronic alternatives like check imaging and electronic debit-card transfers.

Wholesale payments via wire transfer present a much more complex story. Here the role of government has been increasing, especially during the last decade. While private clearinghouses (like the New York Clearinghouse Association) continue to administer significant volumes of large payments in some nations, governments have

¹³ Federal Reserve System (1998).

imposed increasingly severe legal restrictions on them. Central banks have taken steps to protect or enhance their own involvement in wholesale payments. In place of the private marketplace practice of multilateral clearing with end-of-day net settlement, central banks (e.g. the European Central Bank in its TARGET system) have sought and largely succeeded in imposing “real-time gross settlement.” In a strict real-time gross settlement system, payments are settled continuously by immediate transfer of central bank money representing their full or gross value. This procedure is supposed to avoid the "systemic risk" problem that arises when banks extend credit to their customers in response to payment orders that have yet to be settled..

Because it foregoes opportunities for netting, strict real-time gross settlement offers none of the reserve economies available through multilateral clearing and settlement. Consequently it has never been embraced voluntarily by the private sector. Strict real-time gross settlement is costly to banks, compelling them to maintain high start-of-day reserve ratios to avoid a high risk of settlement default, and thereby handicaps them in international competition. To reduce the cost, central banks in most nations (Switzerland is a prominent exception) have granted intraday credits to private banks. Some require that intraday loans be fully collateralized; others do not. In general, real-time gross settlement has gained ground, despite its relative inefficiency, because the more efficient alternative of deferred net settlement has been legally restricted or because the true costs of real-time gross settlement have been externalized via subsidized intraday central-bank loans.

Wholesale payments represent an exceptional case in which market institutions have been yielding ground to state institutions. Will that trend continue, or will market

forces regain the upper hand, allowing banks to take fuller advantage of opportunities to economize on holdings of base money?

To answer this question, we must first consider why governments have been able to expand their role in wholesale payments, despite being compelled by market forces to reduce their involvement in most other areas of the payments system. We have mentioned banks' desire for settlement finality. Finality is typically achieved today by settling on the books of a central bank whose deposit liabilities are (along with paper currency) base money. For a private clearinghouse to settle on the books of a central bank, it must maintain an account with that central bank. The central bank can therefore effectively thwart settlement on its books by any competing private clearing system simply by refusing to grant the clearinghouse an account.

In principle, a competing private clearinghouse could achieve finality without having an account at a central bank. It could have its members settle by physical transfer of fiat currency or, to avoid the costs of moving bundles of paper currency around, by transfer of claims on the clearinghouse itself that are absolutely secure (100 percent backed by currency). Private commercial-bank clearinghouses in the late-19th century U.S. normally used the latter system, holding 100% gold reserves (Cannon 1910).

Clearinghouse members might be willing to sacrifice some degree of payments finality for an interest return. A private clearinghouse could pay interest on settlement accounts by holding fractional reserves of currency and investing the balance of clearinghouse assets in low-risk securities. A central bank that wants to compete for clearing and settlement business could, of course, respond by paying interest on its

deposit liabilities (but not on its currency). It would thereby increase the return on its accounts relative to the return on private settlement accounts.

A commercial bank's incentive to use a central bank for clearing and settlement will still depend on the extent to which the central bank allows its clients to take advantage of economies from multilateral netting. Suppose that a central bank pays an interest rate of y on its deposits, lower than the rate r the commercial bank can earn on non-reserve assets (bank loans), but greater than the rate z that a private clearinghouse pays on settlement balances. At the same time suppose that the central bank's gross settlement system requires a commercial bank to hold N times as much settlement media as a private net settlement alternative. In that case, the opportunity cost of participating in the central bank's system is greater so long as $N(r-y) > (r-z)$. As Jeffrey Marquardt (1994, p. 47) has argued, the reduction or abandonment of statutory reserve requirements (in effect) increases the value of N , by reducing the amount of settlement media a commercial bank has to hold when using private clearing, and thus unintentionally tends to favor net settlement systems.

Some writers (e.g. Eisenbeis 1995, p. 343) argue that ongoing technological trends favor real-time gross settlement. Declining computation costs, in particular, lower the costs of continuously processing transactions. But these same trends also lower the costs associated with multilateral netting, so they are unlikely to decide which system prevails.

One factor that *has* favored government involvement in wholesale payments has been central banks' ability to externalize the costs of intervention. By extending intraday credits at insufficiently risk-adjusted prices, as for example the US Federal Reserve

System does, some central banks (and thus, indirectly, the taxpayers) take on credit risk that should be either avoided or borne by private transactors (including banks). This problem is only part of a more general problem of implicit and explicit central-bank guarantees and related moral hazards. In the case of deposit insurance, at least in the United States, taxpayer losses from morally hazardous banking eventually pushed regulators into limiting the extent of guarantees and instituting some semblance of risk-based pricing. The long run for intraday settlement credits lies in the same direction.

Just how quickly governments disengage from wholesale payments will depend in part on how quickly economists' attitudes change. Economists have generally supported government involvement, at least in principle, believing that a free-market wholesale payments system would present serious externality problems (Folkerts-Landau, Garber, and Schoemaker 1997). With governments around the globe intervening in wholesale payments, there is no free-market benchmark for measuring the inefficiencies of intervention. Although the market-failure arguments against deferred net settlement in wholesale payments are far from convincing (see Selgin 2000), prevailing opinion has yet to change. The private costs of gross settlement are relatively small when the central bank provides intraday credit, and large social costs (losses to taxpayers from subsidized risk-taking) are yet to appear. We therefore expect that government involvement in wholesale payments will not disappear soon.

Yet we should note developments pointing in the other direction. First, the spread of branch banking, not only nationwide (as in the U.S.) but worldwide, will generate an increase in the share of intrabank ("on-us") transactions. That is, the volume of transfers from one customer to another customer of the same bank will increase relative to that of

interbank transactions that require clearing. At the same time, the number of clearing banks will decline, making it easier for the banks to arrive at prior arrangements for internalizing settlement risks. The associated declines in the gross value of interbank payments and in the (supposed) externalities associated with such payments should lead to a corresponding reduction in the perceived urgency of wholesale payments regulation. Second, the consolidation of international currencies will lead to a reduction in the volume of foreign exchange transactions. The corresponding reduction in “Herstatt” risk will alleviate another concern that has motivated government involvement in large-value payments, and the push toward real-time gross settlement in particular. The advent of round-the-clock clearinghouses, with special facilities for coordinating payments between clearinghouses, will also serve to minimize Herstatt risk while preserving the economic advantages of multilateral deferred net settlement.

Implications for Monetary Policy

Many writers have misconceived the implications of future payments evolution for conventional monetary policies.

As we have noted, market forces promote the substitution of privately-issued monies for central-bank-issued money, particularly where the former are interest-bearing and the latter are not, in the portfolios of the nonbank public. Market forces also tend to reduce reliance upon central bank money as a medium for settling interbank balances. The real demand for central bank monies, and hence the real monetary base, will

consequently shrink both in absolute terms and relative to broader monetary aggregates.¹⁴ Some writers imagine that such absolute and relative shrinkage in the real quantity of central-bank monies implies that central bankers will have less control over nominal magnitudes expressed in their currency units. Critics of central banking welcome a new economic era in which central bankers will no longer be capable of creating monetary disturbances. Central bankers themselves fret that they will no longer be able to succeed at macroeconomic stabilization. Both sides share the basic premise that central banks' power to influence nominal and real variables is proportional to the real size of their balance sheets, measured either in absolute terms or relative to the size of broader monetary aggregates.

Thus Kevin Dowd (1998, p. 327), a critic of central banking, envisions a “gradual erosion of central bank power by market forces”, and predicts that as base money becomes less significant, it will gradually lose its effectiveness as a channel through which the central bank can influence the broader monetary system. The fulcrum on which the monetary policy lever operates will erode away and make monetary policy less and less effective as time goes on.

Benjamin Friedman (1999), a supporter of central banking, makes essentially the same prediction in more pessimistic language. He worries that ongoing financial market developments “threaten to weaken or undermine...the efficacy of monetary policy”.

Unlike Dowd, who would like to see the weakening continue, Friedman (1999, p. 338)

¹⁴ Currency substitution may increase the real monetary base of a particular favored currency, e.g. official or unofficial dollarization may increase the real US dollar base, for some time despite an overall trend toward privatization of money balances.

wonders whether “aggressive regulatory changes” may be needed “to preserve the economic relevance of the central bank’s monopoly over the supply of reserves” and thereby prevent unpredictable and undesirable fluctuations in nominal magnitudes.

A recent BIS report (BIS 1996, p. 7) shares Friedman’s view, worrying that the spread of private electronic monies “could shrink central bank balance sheets significantly” and that such shrinkage will eventually “begin to adversely affect monetary policy implementation”. In particular, a substantial enough shrinkage in central bank balance sheets will supposedly undermine central banks’ ability to achieve needed reductions in outstanding stocks of base money by means of open-market sales and other conventional procedures:

The relatively modest size of open market operations on normal days suggests that a relatively small balance sheet might be sufficient.

However, special circumstances could arise in which the central bank might not be able to implement reserve-absorbing operations on a large enough scale...because it lacked sufficient assets.

Such concerns are misplaced. It is of course true that a decline in the real demand for central bank money must be matched by a corresponding reduction in its nominal quantity if inflation is to be avoided. It is generally incorrect, however, to think that a central bank’s power to change monetary magnitudes, including the size of its own balance sheets, declines as that balance sheet shrinks. A central bank becomes impotent only in the limiting case (considered below) where the demand for its money falls to zero. To see why, consider the simple money multiplier relationship, $M = mB$, where B is the nominal quantity of central-bank-issued base money (which is typically the lion’s share

of the liabilities on the central bank's balance sheet). M is some broader money aggregate that includes private exchange media denominated in central bank money, and $m > 1$ is the base-money multiplier. As the demand for base money declines relative to the demand for private substitutes, the money multiplier becomes larger. Any decline in the relative importance of base money is thus matched by a corresponding increase in the *power* possessed by each unit, that is, in the number of units of broad money that will be pyramided upon each outstanding unit of base money. The "fulcrum on which the monetary policy lever operates" becomes *more* rather than *less* effective. The absolute nominal magnitude of open-market operations needed to achieve any desired change in the broad money stock, the price level, or nominal income is scaled down accordingly.

The fear that a central bank's balance sheet might become "too small" to allow it to "implement reserve-absorbing operations on a large enough scale" to achieve a desired policy target is no less groundless. No matter how small the starting value of B , for any given money multiplier, any $x\%$ reduction in B will result in an $x\%$ reduction in M and in other nominal magnitudes, *ceteris paribus*. Unless policy requires that the monetary base be reduced by more than 100% (a *negative* price-level target, perhaps?), it is clearly wrong to claim that central banks might one day be unable to achieve large enough reductions in B .

To insist that any positive demand for central bank money makes it possible for central banks to achieve price-level, inflation, or nominal-income goals using conventional policy tools is not to deny that certain interest-rate targets may become more difficult to achieve as the demand for base money declines. Some innovations that reduce the real demand for base money may also render that demand more volatile. For

example, statutory reserve requirements generate a relatively stable demand for bank reserves, above and beyond the precautionary demand. When reserve requirements are lifted, a bank's demand for reserves becomes a precautionary demand pure and simple, varying not only with the mean quantity of its liabilities, but also with less predictable changes in their variance. A reduced demand for base money may then be associated with greater difficulty in targeting the interbank lending rate, which moves with the demand for bank reserves. The Federal Reserve has long opposed repealing statutory reserve requirements on the grounds that reserve requirements make it easier to target the Federal Funds rate.¹⁵

Other innovations that reduce the demand for base money may actually assist the achievement of monetary policy objectives. If electronic money and other private exchange media come to completely displace base money from the public's currency holdings, and statutory reserve requirements are eliminated, then base money will then be demanded solely for the purpose of interbank settlement. For any given settlement technology and real interest rate, the precautionary demand for settlement balances will be positively related to the volume of transactions, which is equal to the quantity of bank-issued money multiplied by its transactions velocity. With the demand for base money independent of the public's desired ratio of currency to deposits, a frozen stock of base money can achieve near-constancy of aggregate demand. A simple monetary base growth rule can correspondingly achieve a stable growth rate for nominal spending, a

¹⁵ The Fed concedes that statutory reserve requirements are not necessary for controlling inflation or for maintaining the liquidity of the banking system. Other central banks attach less importance to the goal of smoothing interbank lending rates, and have therefore been less opposed to ending statutory reserve requirements. Recognizing the

goal that many monetary policy theorists favor (See McCallum 1989, Bean 1983, Bradley and Jansen 1989). Suppose, for example, that the market for bank reserves is initially in equilibrium with a given stock of base money. An increase in the quantity or velocity of bank-issued money will mean an increased demand for reserves, which will bid up the interbank lending rate. The consequently higher cost of reserve shortfalls will in turn encourage banks to restrict their issues. Aggregate demand – the total volume of spending on goods and services – will thus tend to be a relatively stable multiple of the stock of base money (Selgin 1994). Financial deregulation and monetary privatization can help to reduce the size and frequency of fluctuations in aggregate demand and thus of business cycles.

In a future world of globalized currencies, the stabilizing tendency just described will not act on *national* income, but on *worldwide* income in dollars, euros, or yen. International dollar flows will mean that changes in the volume of dollar income within the U.S. will tend to be offset by opposite changes in dollar income elsewhere. The invisible hand's potential contribution to macroeconomic stability must be understood in terms of *global* stability rather than stability of traditional national targets. Fluctuations in national indicators will tend to reflect underlying changes in the worldwide distribution of demand for money and goods. Like fluctuations in the relative fortunes of subnational regions today, they should not be taken as evidence of any monetary policy failure.

Future payment-system innovations that privatize and globalize currency do not threaten macroeconomic stability, but they do threaten the seigniorage profits central banks derive from issuing fiat currency. Market forces for currency privatization and

competitive disadvantage to U.S. banks, Fed officials have proposed to pay interest on

globalization will act most strongly on the worst (highest inflation) currencies, which are not coincidentally issued by those governments that use seigniorage to finance the largest shares of their budgets (see Click 1998). Reduced seigniorage will force them to undertake some combination of expenditure reductions and increases in other tax revenues. The market forces that reduce governments' role in money may thereby also promote a more general reduction in the scope of government.

Where the real domestic monetary base shrinks far enough (the limiting case being where it shrinks to zero with complete privatization or dollarization), seigniorage will become too small to cover the central bank's budget. The central bank will become a fiscal drain rather than a source of profit. An explicit budget appropriation will make the expense of its operations more transparent. Political pressure will then arise for reducing the size and scope of central bank operations. Governments whose profits from central banking have turned small or even negative will become more favorable toward alternatives, such as currency boards or official dollarization. The process of monetary denationalization may thus become self-reinforcing in a manner reminiscent of the Mengerian monetary selection process.

Whither Fiat Money and the Price Level?

So far we have assumed that the demand for central bank money – or at least the demand for the money of a few central banks – remains positive. Private monetary innovations and deregulation will reduce the demand for central bank money, but are unlikely to eliminate that demand entirely. Private monies will continue to take the form of redeemable claims to central bank money. Whatever their practical advantages, such

reserves in lieu of abolishing reserve requirements.

claims necessarily pose a positive default risk and positive information costs (about the current size of that risk, if nothing else), making central bank money uniquely default-risk-free and liquid. These risk and liquidity advantages will likely preserve some demand for of central bank money even if cryptographic and clearing innovations (as discussed above) make private monies equally anonymous.

As noted above, central bank money is especially likely to continue to serve as a medium of settlement among private money issuers, both because of its freedom from default risk and because of the low transactions costs involved in settling on the books of a central bank. Settlement of the books of a private clearinghouse association bank would lack the same finality. Banks with positive clearings would find themselves holding less-than-perfectly-secure clearinghouse-issued claims to base money, rather than base money itself, an asset of unambiguous nominal value. The desire for payments finality is perhaps the most fundamental reason that a demand for central bank money is likely to persist.

Even so, a complete substitution of private for central bank liabilities remains a distinct (if remote) possibility with interesting economic implications. Network effects, as we have noted, give private issuers the incentive to continue to denominate and redeem their monies in units of central bank issued base money. Such private monies will remain valuable only so long as base money remains valuable. As the real demand for base money declines, the central bank must correspondingly reduce its nominal quantity to preserve its value. As the demand for central bank money approaches zero, its quantity must also approach zero to keep nominal prices from rising toward infinity.

But what happens if the demand for base money actually reaches zero? What happens if banks no longer maintain accounts with the central bank (preferring instead to settle using private clearinghouse balances backed by interest-earning government debt), and if other firms and consumers no longer hold central bank notes? In that case, every outstanding unit of central bank money would be a “hot potato,” not wanted in anyone’s portfolio. Even the tiniest nominal quantity of base money would generate an infinite price level, rendering both base money and the private money denominated in it worthless. In such a world monetary privatization would be a victim of its own success, ushering in nominal indeterminacy and presumably opening the door to financial and economic chaos.

Thus, although he is wrong to suggest that a central bank’s ability to control nominal magnitudes declines continuously with the size of its balance sheet, Benjamin Friedman (1999, pp. 337-8) is essentially correct in making the following observation, which assumes fiat money:

At its most basic level, economic theory provides no clear answer to what would determine an economy’s price level if what its inhabitants used as money depended entirely on their own ability and willingness to innovate, without effective restraint from the central bank or some other monetary authority.

Some economists reject Friedman’s statement, and similar earlier statements (e.g. Milton Friedman and Anna Schwartz 1986, p. 5), even while accepting (at least for the sake of argument) the premise of a zero demand for central bank money. Some base their rejection on an improper appeal to the mathematics of limits. Thus Stacey Schreft and

Bruce D. Smith (2000), supposing (dubiously) that “the demand for base money may virtually or entirely vanish in the not-too-distant future,” argue that a zero demand for base money would “pose no threat to the traditional methods employed for conducting monetary policy.” Their claim rests, however, upon their having confused what happens “if the demand for base money asymptotically goes to zero” (p. 3) with what happens when it actually *reaches* zero, which is another thing altogether.

To see why, consider an economy with a positive demand for base money and an initial price level P . Following the standard equation of exchange, let $P = M/(y/V) = M/m^D$, where M is the nominal stock of base money, y is real output, V is the velocity of base money, and m^D measures the real demand for base money. It is true that, as m^D *approaches* zero, some percentage reduction in M (a “traditional...monetary policy”) will suffice to keep the price level constant. But once m^D actually reaches zero, P becomes undefined, a ratio with zero as its denominator. No reduction in the nominal quantity of base money will suffice to maintain money’s purchasing power once it ceases to be wanted by anyone.

Other economists conclude that conventional monetary policy can be carried out, despite assuming a zero demand for base money, only by failing to think through the implications of the assumption. Thus Charles Goodhart (2000, p. 24) writes that “neither currency, nor banks, are essential to the ability of a Central Bank to set the interest rate in its own country” because the Central Bank, being a non-profit-maximizing entity, “is always in a position to dictate the finest terms on either the bid, or the ask, side of the money market” (ibid., p. 27). In identifying monetary policy with the manipulation of money-market interest rates, Goodhart neglects fundamental questions having to do with

the supply and demand for base money. What “money market” does he have in mind, in which the central bank can meet any excess demand or absorb any excess supply at the going interest rate, if not the market for final settlement media taking the form of deposit credits on the books of the Central Bank?? Who are the demanders in this market, if there are no banks, and what use do they have for central bank liabilities? Finally, granting as Goodhart does (p. 25) that “real factors [will still] determine ... the real interest rate” in the long run, what will determine *nominal* rates when there is no limit to the velocity of base money and (therefore) no anchor to prices expressed in the traditional unit of account?¹⁶

Knut Wicksell (1935), addressing the question in a gold-standard context, believed that monetary evolution and financial stability were ultimately incompatible. He argued that unimpeded market forces would lead to the development of a “pure credit” system of exchange that would eliminate any need for gold as an exchange or settlement medium. In such a system, the existence of an industrial (nonmonetary) demand for gold would prevent gold from becoming utterly worthless, thus allowing it to continue to serve as the economy’s medium of account. But the relatively volatile nature of the industrial demand for gold, he thought, would render a “pure credit” gold standard highly unstable. As a way out of this imagined future predicament Wicksell proposed –ironically enough – a switch to fiat money. He apparently overlooked the possibility that a fiat-money

¹⁶ Of course, the central bank could in principal re-establish a nominal anchor by redefining the monetary unit in terms of some other still-scarce asset and by making its liabilities genuine claims to that asset, and, hence, no longer fiat money in the usual sense of the term.

Goodhart (2000, p. 25) claims that Michael Woodford (2000) reaches conclusions closely resembling his own. In fact Woodford’s analysis takes for granted a continuing

system might also become a “pure credit” system, with private IOUs displacing central bank money, thereby making fiat money (which by definition has no industrial use) utterly worthless.

The forces that favor the future substitution of commercial-bank-issued for central-bank-issued money appear less powerful than those that historically favored the substitution of banknotes and checkable deposits for gold and silver coins. Coins were a relatively clumsy medium of exchange. Users of banknotes and deposits found them much more convenient. (And they lost little in the way of security: bank defaults were minimal in countries without perverse legal restrictions on banks, and some bank liabilities were presumably *more* secure from theft.) E-money and redeemable banknotes have yet to demonstrate any similarly great convenience advantage over fiat central bank notes. Should technical innovations promise to give private monies a decided edge, central banks might respond to the potential competition by embodying similar innovations in their own liabilities.

With respect to retaining the demand for base money as a settlement medium, nothing prevents central banks from paying interest on the deposit portion of the monetary base that commercial banks hold for interbank settlements. Such a reform could offset private innovations, such as interest-bearing private settlement accounts, that might otherwise erode the demand for base money. The Federal Reserve views such interest payments as means for enhancing the efficiency of the U.S. banking system without scrapping statutory reserve requirements. International competitive pressures and a dwindling demand for central bank money may eventually force central banks to

positive demand for base money as a bank reserve medium, albeit a demand that may

pay interest on reserves, at a rate equal to the rate earned on central bank assets minus intermediation expenses, even where reserve holdings are entirely voluntary. The possibility that the demand for base money will fall to zero even when it bears interest seems to us remote enough to conclude that fiat money is, after all, likely to survive foreseeable financial innovations.

only be sustained by means of interest payments on reserves.

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