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Abstract

What implications do 21st century monetary innovations bring for holdings of central bank money and standards of value? Emerging technologies such as cybercash, e-cash, and smart cards can be expected to reduce demand for central bank money, but the theoretical framework for monetary policy has not changed. The authors stress three points in this paper: 1) money innovations tend to reduce the demand for central bank money, but it remains to be seen whether the predictability of that demand, and thus the reliability of monetary policy, will decline in the coming century; 2) in principle, monetary authorities can continue to determine the price level as long as final settlement of tax and other obligations takes place using central bank liabilities; and 3) the viability of competing currencies and standards of value is gaining steam as a lively field of research.

Innovation in money is nothing new. For centuries, the fundamental forces of technological innovation and market competition have been altering both the forms in which money is held and the methods by which its ownership is transferred.

What *is* new in the present dialogue are the technologies used to make payments and their names, such as cybercash, e-cash, and smart cards.

What is *not* new are economists' underlying concepts and theoretical framework for thinking about monetary policy. Goods and services are still what we use to satisfy our wants. Money prices are what we use to state the values of goods and services. The mission of monetary policy is to maintain stable purchasing power, avoiding both deflationary excess demands for money and inflationary excess supplies of money.

What we need to *change* in the emerging dialogue is our use of conventional terms that have been only temporarily meaningful in the 20th century, such as "deposit" and "commercial bank." A growing segment of the public can see no real distinction between a deposit and either a mutual fund share or a transferable, interest-bearing credit balance. Similarly, the statutory distinction between a financial firm chartered as a commercial bank and another financial firm that offers many of the same services, but has no bank charter, is not important.

Looking out over the next century, it is not possible to predict how fast things will change, and exactly what forms innovations will take. Indeed, much uncertainty remains about the central bank implications of potential changes in monetary mechanisms. Three points:

- Money innovations in the past have tended to reduce the demand for central bank money, but the reliability of monetary policy depends less on the amount

demanded than on the predictability of that amount. Innovations probably will reduce demand for central bank money even further in the 21st century, but it is much too soon to say whether the predictability of that demand, and therefore the potential reliability of monetary policy, will be significantly reduced.

- Some analysts contend that holdings of central bank money (currency and deposits at the Reserve Banks) will virtually disappear in the next century--just as commodity money holdings have done in the 20th century. Nevertheless, monetary authorities will still determine the price level as long as final settlement of tax and other obligations takes place using central bank liabilities.
- Whether the declining demand for central bank money might influence the role of national currencies as primary standards of value is not yet known. We are encouraged, however, that both theoretical and empirical economic research are focusing energies on this topic. The possibility of a stable, privately issued currency that is not convertible into a national currency is the subject of a growing literature.

After a brief overview of innovations in money regimes, we elaborate on each of these points.

Innovations in Money Regimes

Our view is that people choose to use as "money" those devices that economize best on the use of other real resources in gathering information and conducting transactions, and that high-confidence moneys drive low-confidence moneys out of common usage. Monetary history records repeated innovations in the assets that have been readily transferable stores of value, and in the mechanisms used for transferring

those asset values. As recently as the 19th century, "money" meant both the money storage asset and the money transfer mechanism. Full-bodied commodity money, fractional coin, government fiat currency, and bank notes all provided assets for storing value and, at the same time, vehicles for instantaneous, face-to-face transfers of value, with finality.

The inconvenience of making face-to-face payments in an increasingly integrated national economy was avoided by accepting the cost and risk of delayed payment finality. Local clearinghouses became part of the transfer technology, facilitating both the clearing and settlement of checks drawn on asset values stored in local bank deposits. At greater distances, payers could purchase "exchange," consisting of a local bank's check drawn on its distant correspondent, which could then be mailed to the payee, bringing the post office into the transfer mechanism. The U.S. Post Office, as well as some commercial enterprises like American Express, operated independent paper money-order services for transferring money values over distances, while Western Union did the same thing by telegraph.

In the first decades of this century, telegraphic transfers of balances for same-day value were the cutting edge of money technology. The dominant retail money technology was still shifting to paper checks drawn on commercial-bank demand deposits. Over the past several decades, rapidly declining costs of computing and telecommunications have allowed a wider variety of assets to be exchanged very quickly, fulfilling some of money's "store of value" functions, but these assets are only indirectly capable of being transferred to third parties.

Successively broader definitions of money (M_2) in the U.S. have recorded the widening field of effectively monetized assets. As we come to the end of the century, M_2 includes NOW (negotiable order of withdrawal) and money market deposit account balances at banks and nonbank depository institutions; shares held in money market mutual funds; plus the original combination of currency, demand deposits, and small time and savings deposits. This certainly commingles "dollars" and assets denominated in dollars. Moreover, value held in all these assets can be transferred directly to third parties by paper or electronic payment orders or, at least, moved so rapidly from one kind of account to another as to be indistinguishable from a direct third-party transfer.

The increasing speed of transactions has been a critical part of the innovation process. At the cutting edge of money technology, corporate America is moving beyond batch processing and air couriers, to networks for integrated accounting and payments processing systems. The definition of an instantaneous money transfer--not by check, but by ATM or direct computer connection--is moving inexorably toward "real time," on a par with exchanges of currency, but without the need to be physically face-to-face. And the closer technology brings us to real-time *remote* payments, the closer we are to genuine 24-hour banking and trading, and a worldwide set of assets that might be used for wealth storage, at least for those who are willing to accept some currency risk.

The proliferation of money assets and increasing speed of money transfers are two trends that clearly will persist into the next century. So, too, will a third trend--the elimination of regulatory and other legal restrictions on the money industry erected by governments. On a global scale, modern communications technology ensured the free flow of information through the Iron Curtain and flattened the Berlin Wall. In the United

States, that same technology has demolished artificial walls between groups of depository and other regulated financial institutions, and between regulated and unregulated institutions. Telecommunications-based information technology has made it ever cheaper to avoid costly regulations. Initially, this perpetuated a kind of cat-and-mouse game between regulators and markets. In banking, at least, that game now is ending. For example, last year brought the advent of accounting programs that sweep reservable deposits temporarily into nonreservable form for all the retail deposits of a bank, not just its corporate cash management customers. As a result, the average reserve requirement tax rate is becoming ineffective at a vast majority of depository institutions.

The rapid spread and ultimate success of sweep programs epitomizes 50 years of experience with erecting and flattening arbitrary regulatory walls between industries. In the long run, those walls won't stand. Regulation created profit incentives for banks to avoid reserve requirement and deposit rate ceilings and line-of-business restrictions by taking their money business outside the traditional orbit of the banking industry, lest it be taken there by nonbanks. The same restrictions created incentives for banks' competitors to bring the business of banking into the orbit of nonbanking industries. Sometimes the banks prevailed; sometimes nonbanks prevailed. Never did the regulators prevail, and the walls have come tumbling down. Regardless of whether Congress ever removes Glass-Steagall restrictions, the long-run futility of using regulations to enforce arbitrary restrictions seems well documented.

Past Innovations and the Demand for Central Bank Money

Descriptions of smart card and Internet moneys suggest that developers of electronic moneys might be nonfinancial organizations that build on foundations already

laid by their existing, unique product lines. A subway system might move from a stored-value fare card toward a more general-purpose stored value card. A long-distance carrier might build on its nationwide commercial and consumer network.

The predicted impact of such innovations on the central bank has a familiar ring. Around the turn of the century, as the use of checking accounts became widespread, analysts recognized that these deposits were substitutes for traditional gold and paper money. To account for the effect of this substitution on what we now call monetary policy, discussion focused on the resulting increase in the level of national income relative to the quantity of what was the equivalent of today's central bank money. Then, in the 1950s, the thrift industry enjoyed overwhelming competitive success in providing assets that were so liquid as to be close substitutes for checking account deposits at commercial banks. Experts recognized that the ratio of national income to a noninflationary supply of central bank money increased when thrifts issued monetary assets without holding significant reserves of central bank money. In the 1970s, discussion focused on electronic funds transfer systems. Once again, the concern was about increases in the ratio of national income to a noninflationary supply of central bank money resulting from reduced needs for inventories of money. Electronics was expected to allow existing moneys to be transferred with greater speed and precision over emerging telecommunications networks that would link merchants and customers and banks.

Innovations in monetary assets and transfer systems complicate monetary policy decisionmaking by producing short-run changes in the quantity of central bank money that would be consistent with stable purchasing power. Monetary targets are more difficult to define and achieve during the transition from one type of money regime to

another. But a smaller demand for central bank money does not, by itself, make it forever more difficult to maintain financial stability. The issue is whether there can be offsetting increases in the precision with which the central bank can control the supply of its monetary liabilities. We are not aware of anyone who suggests that the long-run decrease in the demand for the monetary base relative to the nominal level of national income has led the Federal Reserve seriously astray, allowing the purchasing power of the dollar to fluctuate as much as it has in the 20th century or to decline as much as it has in the postwar period. However rough, the policy process can still operate through feedback directly from movements in the observed price level.

Checking the facts against the expectation of reduced demand for central bank money is instructive. Despite all the new types of monetary assets and transfers, the average annual growth rate of the monetary base has been only about 1.5 percentage points slower than the growth rate of nominal GDP since 1959, when the current monetary data series began. The deposit component of the base has been growing 4 percentage points slower than nominal GDP each year, on average, while currency has been growing at about the same rate as nominal GDP. These results are influenced, however, by outflows of U.S. currency to foreign markets that have needed a more reliable money than provided by their own central banks. If we assume that foreign holdings of dollar currency have gone from a negligible percentage of the total outstanding in 1959 to almost two-thirds today, then *domestically* held central bank money has been increasing at a rate 3 percentage points slower than nominal GDP each year over the last third of the century.

Future Innovations and the Demand for Central Bank Money

Looking ahead to the 21st century, we can expect continued reductions in the demand for central bank money. Substitutes for, and economizers of, current money assets, and increasingly sophisticated money transfer systems, all are on the horizon.

But will this just be a case of "deja vu all over again," another episode of innovation shifting the demand for central bank money, making short-run mischief with quantitative monetary targets? Perhaps not, for another possibility must be recognized. The kernel of the money question emerging on the 21st century horizon is not just about further reductions in demand for central bank money, or even instability induced by more unpredictable demand. Rather, what may distinguish the 21st century is the possibility that central bank money might virtually disappear. Some have posed the theoretical possibility that, in the limit, there will be no appreciable domestic demand at all for central bank money--whether currency or banks' balances at Reserve Banks.

Discussions of smart card and Internet moneys hint at this radically new monetary future, which has little place for central bank, high-powered base money. One focus is the degree to which value embedded in smart card memories will be the liability of commercial firms or of financial institutions, and whether traditional regulations such as reserve requirements and capital ratios might extend to smart cards, whoever issues them. These questions, while important in the short run, may be largely beside the point in the long run. Reserve requirements already are becoming a dead issue, killed by technology and competition. Capital ratio requirements are meeting the same fate, from the same forces: To the extent that capital ratios might be made more onerous than the value of the

safety net services they buy, they are unlikely to survive in the long run. Thus, regulation of new electronic moneys is unlikely to create a demand for central bank money.

Smart card and Internet moneys must meet quality control standards in some form, of course, either from safety net supervision or from pressures of customers and competitors in the market. Safety and soundness will always be relevant to customers' choices among moneys. Similarly, the relative quantities of these moneys will be controlled by their success in competing with alternative monetary assets and transfer mechanisms like credit cards and debit cards, as well as paper checks and electronic transfers of account balances.

Issuance of successful electronic moneys by the central bank itself would ensure a continuing demand for central bank liabilities. The object would be to allow electronic payments with the finality of paper currency, but with the divisibility, security, and ease of transportation associated with the new electronic devices. This possibility should not be ruled out. For now, however, neither government regulation of private issuers nor direct government issuance of electronic forms of currency seems likely to ensure significant demand for central bank money over the next century.

Today, complete substitution of electronic moneys for currency in domestic use would still leave a substantial quantity of central bank money outstanding. Foreign holdings, remember, are estimated to represent about two-thirds of the value of U.S. currency now outstanding. The durability of this demand may depend more on the relative qualities of U.S. and foreign monetary management in the next century than on the relative costs and features of currency and its electronic substitutes. It is not at all clear, however, even if the U.S. were assured of another century of foreign demand for

central bank money, that controlling the supply of currency to foreign holders would be effective in conducting domestic monetary policy.

Another hint of a radically new 21st century monetary future comes from looking at the demand for central bank money by depository institutions. If technology and competition were to eliminate demands for currency by the general public, then depository institutions' derived demand for vault cash also would wither. Moreover, technology, competition, and regulatory actions have already eliminated a substantial part of the demand for Reserve Bank balances to satisfy reserve requirements. This process could continue until virtually no bank in the U.S. was constrained by reserve requirement regulations as currently structured. Therefore, low reserve requirements may be just as untenable tomorrow as high requirements proved to be in the past.

Reserve requirements are not the only reason for maintaining an account balance with a Reserve Bank. Many depository institutions maintain clearing balances at Reserve Banks. One reason is to provide a cushion to protect against daylight and overnight overdrafts. Another is to earn a market-based rate of return, although it can be used only to pay for financial services provided by the Reserve Banks.

Neither reason for holding a clearing balance is a very robust source of demand for central bank money. Overdrafts can be avoided in other ways. One is to apply information technology to the sequencing of debits and credits during a day to minimize daylight overdrafts and avoid surprise debits at the end of a day. Another is to organize and participate in multilateral clearing and net settlement arrangements for money and securities transfers. Substituting these for Reserve Bank services could reduce the need for an overdraft cushion.

These and other alternatives to holding balances may not be especially attractive today because banks tend to use the Reserve Banks' priced payment services in sufficient volume to make earnings credits valuable. Over time, however, definitive paper instruments will lose market share, eventually rendering check and noncash collection services obsolete. Moreover, commercial competitors are likely to continue making inroads on the growing automated clearinghouse market that once was the almost exclusive domain of the Reserve Banks. Unless the Reserve Banks develop appealing new services, much of their bankers' banking seems vulnerable to technological obsolescence.

It is not a complete flight of fancy to foresee central bank money becoming insignificant in the domestic economy. In time, the public may find commercially provided electronic money attractive as a replacement for currency. Reserve requirements are not likely to provide a solid floor under the demand for Reserve Bank money by depository institutions. Finally, demand for clearing balances at the Reserve Banks could decline as earnings credits become less valuable.

What Role Remains for the Central Bank?

Even with little public demand to hold central bank liabilities, central banks remain the only source of the national currency units that are required to settle domestic tax obligations. Furthermore, for the foreseeable future, final net settlement of imbalances between various competing, privately issued electronic moneys will be in the form of central bank liabilities. The Federal Reserve, and every other central bank of which we are aware, provides settlement finality as a payments service. Final settlement

represents an ultimate, official guarantee of values exchanged by Reserve Bank depositors and their customers. Finality may be rendered on a gross basis, as the Reserve Banks do in making immediate, irrevocable Fedwire transfers, or on a net basis, as the Reserve Banks do in settling the zero-sum, end-of-day positions of depositors who belong to a multilateral clearing house arrangement like CHIPS.

Central banks effect settlement when they post irrevocable debits and offsetting credits to two or more depository institutions' account balances. In the United States, those account balances must be zero or positive at the end of each day, and typically total in the $30 billion range. At the Bank of England, in contrast, aggregate balances are close to zero at the end of each day. This highlights the fact that *overnight* balances are not necessary, either in the aggregate or for an individual depository institution, as long as the supply of *intraday* balances is sufficient to accommodate mismatched flows of depositors' receipts and payments, without payments gridlock. Intraday balances might come from central bank intraday credit, as in real-time gross settlement systems like Fedwire. Alternatively, participants in payments networks like CHIPS might supply intraday credit to one another, economizing on the need for central bank balances by delaying finality until one or more net settlements during the day.

Looked at in this way, the central bank's settlement function could continue, even if holding central bank money overnight were no longer a widespread practice. Central bank money may not be used as an asset for storing value overnight and longer, but could still be critical as a vehicle for transferring value during a day.

The monetary policy function of the central bank--maintaining constant purchasing power of the standard of value, or unit of account--still must be fulfilled, even if central bank deposit liabilities denominated in the national currency unit enjoy only a fleeting existence during the course of each day. As it is now measured, the long-run equilibrium value of the domestic demand for monetary base could approach zero at the close of business each day. The policy authority, however, could still control the terms on which payments system institutions would acquire balances needed to make payments during the day. It could also control the terms on which institutions would rid themselves of excess balances accumulated during the day, in order to return to a zero balance at the close of business. Treasury and central bank payments and receipts, at least, would be critical factors in determining whether depositories developed an aggregate net debit or net credit position at any moment during a day, just as is the case today. The mechanisms a central bank might find useful in controlling the intraday supply of its liabilities to the private sector could be quite different from those now used to maintain more than $400 billion in overnight liabilities, but the principle involved--zero excess supply and demand at a desired level of a money market interest rate--would seem to be essentially the same.

We have just illustrated how the central bank's settlement and monetary policy roles might be carried on in the next century, even in the absence of a conventional demand for central bank money. "Might be carried on" is different, of course, from "will be carried on," and we confess to uncertainty about the impacts of less-readily analyzed pressures for change that might accompany declining demand for central bank money.

Conclusion

We can foresee the possibility of only fleeting daily demands for central bank money in the 21st century, but we can neither predict that outcome, nor forecast its consequences on payments settlement methods and mechanisms for managing the purchasing power of the unit of account. Our uncertainty is relieved, however, by seeing one direction in which academic research has been moving. The general topic of "free banking" can be thought of as dealing with how an economic and financial system would operate in the absence of state interventions such as a central bank. Alternative definitions of "free banking" are being used, it's true, ranging from a money industry in which banks operate without reference to a common unit of account, to a money industry not much different from the long-run situation we have been assuming, in which financial markets avoid all regulations that provide no quid pro quo. Nonetheless, research evolving in these directions is precisely what is needed for the next century, when there is a good chance that central bank money will not be in much demand.