Forum on the Development of Electronic Payment Technologies and Its Implications for Monetary Policy: Interim Report

Executive Summary

In December 1997, the Bank of Japan established the Forum on the Development of Electronic Payment Technologies and Its Implications for Monetary Policy. The objectives of the forum were to analyze the emergence of electronic means of payment including electronic money and its implications for monetary policy. The forum has met eight times and discussed a number of issues. This report summarizes the main findings of the forum.

• Definition and Development of Electronic Means of Payment

The term "electronic means of payment" is defined, in this report, as payment services that utilize information and communications technologies including integrated circuit (IC) cards, cryptography, and telecommunications networks. For the purposes of this report, electronic means of payment are categorized into either stored-value products or access products. Stored-value products are the instruments of effecting payments electronically by storing the record of funds in an electronic device in the consumer's possession such as an IC card or a personal computer together with appropriate software. The amount of stored value is increased when cash or deposits are received, and it is reduced when goods or services are purchased. By contrast, access products are instruments of effecting payment electronically by accessing conventional payment services including electronic fund transfers via computer networks such as the Internet.

While electronic means of payment are undoubtedly suited for electronic commerce transactions over computer networks, it is difficult to tell whether they will be widely used also for face-to-face transactions. Stored-value products have been developed primarily for micro-payments. Since there is no interest paid on the stored

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value, the higher the transaction amount the greater the loss of interest (opportunity cost) that should be accruing during the period after converting cash and deposits into electronic value stored but before making payments for transactions. As such, stored-value products are likely to be used only for small-value transactions in the foreseeable future. In the meantime, access products will probably be used for transactions involving relatively larger amounts.

There are several possible scenarios describing how electronic means of payment could develop. For example, if so-called digital goods such as news, books, and music—the value of which lies in the information rather than the physical medium—come to account for a greater part of the overall economy, the use of electronic means of payment may increase. If the function of stored-value products as payment instruments were supplemented with interest payments, it would have a greater potential to become a substitute for deposits. Many factors impinge on the development of electronic means of payment, including unexpected technological advances, and this makes it difficult to theoretically anticipate its future direction. Therefore, these developments should be monitored closely.

- **The Development of Electronic Payment Technologies and Its Implications for Monetary Policy**

Using economic theory, the forum participants examined the issues that the development of electronic payment technologies—including the emergence of both stored-value products and access products—would raise for the central bank in implementing monetary policy. A relatively prevalent view among the forum participants was that the new electronic means of payment could be regarded as a new form of private bank debt that could be used as a payment instrument and, if further simplified, as a new type of deposit.

Based on a simple monetary multiplier model, if electronic means of payment were substituted for cash and deposits but were not subject to reserve requirements, the development of electronic means of payment would increase the money multiplier. However, several remarks should be noted in this respect. First, it is highly likely that, in the process of the development of electronic means of payment, the money multiplier will be destabilized and therefore will become harder to predict. Second, the simple money multiplier model makes no distinction between lending by banks and lending by issuers of electronic means of payment, and such a premise would be inappropriate if the latter were subject to prudential regulation. Third, even if the issuers create credit, it is unrealistic to conclude that the credit will be created infinitely.

With regard to the demand for money, the development of electronic payment technologies would reduce the cost for consumers to convert deposits to cash (the cost of visiting banks), would have the effect of saving non-interest-bearing cash outstanding, and thus would reduce the demand for money. It should be noted that, in the process of the development of electronic means of payment, various shocks unanticipated by the central bank could occur both from the money supply side and the money demand side. Applying Poole's classical theory, it would be generally desirable for central banks to adopt interest rate stabilization policies

if the widespread use of electronic means of payment were to cause frequent and unanticipated shocks to the monetary sector (the LM curve).

Most central banks set targets for short-term interest rates. In considering how the development of electronic payment technologies affects central banks' ability to control short-term interest rates, it would be necessary to study the possible impact of such a development on reserve demand and on the reserve requirement system. It is likely that reserve demand would decrease, because the spread of electronic means of payment would encourage a shift from deposits that are subject to statutory reserve requirements to electronic payment instruments that are not. However, in controlling short-term interest rates, the size of the reserve demand would not be so critical as the stability and predictability thereof. In other words, what is important would be for the issuers of electronic payment instruments to make payments final through current accounts at the central bank in a stable and predictable manner. Therefore, it is necessary to study, from a wide range of perspectives, the impact that the development of electronic payment technologies would have on the existing payment systems.

It is important to keep reserve demand stable for the implementation of monetary policy. To achieve it, possible policy responses might be to apply the same reserve requirements to all payment-oriented financial obligations, to pay interest on reserve deposits, or to abolish reserve requirements altogether.

The participants in the forum did not agree on whether electronic means of payment had the potential to become a substitute for central bank money in the future. This issue will require further research.

• Electronic Payment Technologies and Cross-Border Transactions

The development of electronic payment technologies might increase cross-border electronic commerce transactions, together with such other factors as the liberalization of foreign exchange controls. As cross-border transactions become more prevalent, they might encourage consumers to hold more foreign currencies for payment purposes in order to reduce foreign exchange risks, and to hold more foreign currencies for savings purposes through Internet banking.

In short, holding foreign currencies could be either for payment purposes or for savings purposes. These two should be distinguished when considering the implications of the increased use of foreign currencies for monetary policy.

When foreign currencies are used for payment purposes, a part of domestic economic activities would be settled in foreign currencies and therefore the capability of domestic currency interest rates to influence the domestic economy would be impaired. When foreign currencies are held for savings purposes, there would be a stronger arbitrage of the domestic long-term real interest rate against those in other countries. In either case, the central bank would be able to maintain its ability to control domestic short-term interest rates by providing base money in the domestic currency. However, under such circumstances, the central bank would be required to pay closer attention to foreign economies and foreign exchange markets when implementing its domestic monetary policy.

I. Preface

Rapid advances in information technology are producing a new digitalization of payments. In the private sector, there have been a number of electronic money pilot programs conducted around the world geared generally at consumers, and efforts are now under way to raise electronic money to commercially feasible levels. Meanwhile, governments around the world have been preparing environments that will encourage the sound development of electronic payments. In Japan, the Study Group on an Environment for Electronic Money and Electronic Payments, a subsidiary organization of the Financial System Research Council, issued a report in June 1998, and legislation to support such development is in preparation.

Electronic money and other forms of electronic means of payment offer such a high degree of convenience that they could potentially replace not only the cash that is now supplied under central bank monopolies but conventional bank deposits as well. Electronic means of payment have the potential to impact monetary policy in no small measure. A 1996 report from the Bank for International Settlements (BIS)[1] notes that the development of "electronic money" raises a number of policy issues for central banks because of the possible implications for central bank seigniorage revenues and monetary policy and because of central banks' general interest in payment systems.

In December 1997, the Bank of Japan established a forum to examine the issues in monetary policy raised by electronic payment technology and potential policy responses from both theoretical and practical perspectives. The forum has met eight times, during which it held vigorous discussions of jointly authored papers by forum members (experts from academia and government) and the secretariat staff.[2] This document is an interim report that introduces some of the arguments made in the forum papers and the major points that emerged from discussions at the forum. The opinions contained herein do not necessarily represent the official positions of the Bank of Japan or of the Ministry of Finance and the Economic Planning Agency, which attended the forum as observers.

Electronic means of payment are still in development, and it is virtually impossible at this time to accurately predict how and in what form they will spread. The purpose of the forum is to engage in thought experiments using the major features of existing electronic means of payment, current economic theory, and examples of financial technology advances around the world. The forum confirmed that the spread of electronic means of payment could result in phenomena similar to those already experienced in other situations, and underscores the potential for electronic payment technology to change existing economic structures and the economic order structurally.

Below is an overview of the structure of the report.

Chapter II describes what is currently known about electronic means of payment, including definitions of the terms and concepts in this report, classifications of the

1. See the BIS, *Implications for Central Banks of the Development of Electronic Money*, 1996.
2. See Attachment 1 for a list of members and Attachment 2 for a description of the discussions.

forms of conceivable electronic means of payment and summaries of their positions within the overall monetary framework. Following this, the report provides a broad list of potential avenues for long-term development.

Chapter III examines arguments concerning the impact that the spread of electronic means of payment will have on the macroeconomy as a whole and on monetary policy in particular. The report begins by considering the impact that the spread of electronic means of payment will have on the credit creation process and then briefly examines how this will influence consumers' demand for money. From there, the report examines the impact on monetary regulation, which is the front line of monetary policy for central banks. The chapter refers to potential policy responses, including modifications to the reserve requirement system. The chapter concludes with a discussion of the influence that the spread of electronic means of payment will have on central bank seigniorage and raises issues about whether electronic means of payment will be able to take the place of the currencies issued by central banks.

Chapter IV focuses on the potential for electronic means of payment to promote cross-border transactions and payments, and examines the influence on monetary policy in cases where foreign currency payments are prevalent.

Chapter V sets out the issues still to be examined in light of discussions at the forum to this point.

II. Electronic Payment Technology Defined

A. Electronic Payment Technology and Electronic Means of Payment

This forum covers the **electronic payment technology** that provides a vehicle for the electronic payments that are being actively developed around the world using IC cards, cryptography, telecommunications networks, and other information and communications technologies. This report refers to specific payment services utilizing these technologies as **electronic means of payment**. Most of these means will for the foreseeable future be provided primarily for retail transactions. **Electronic money**, which has been the subject of several pilot programs around the world, is one example of an electronic means of payment.

Electronic payments have already been widely used in wholesale transactions, i.e., in transactions between the central bank and private banks and between private banks and large companies. However, little progress has been made on the introduction of electronic payments into the retail area, for example, because of the cost issues involved. In recent years, this has changed, and many electronic means of payment have begun to be provided primarily for retail transactions. There are two major reasons for this: (1) advances in information and communications technologies have made it feasible to provide electronic payments at low cost, and (2) newspaper and magazine articles, music, and other forms of information, which are targeted at retail transactions, have been provided in digital form, so there is a greater need to buy and sell these products electronically.

Several technological factors were at work in making it possible to computerize retail payments: (1) the development of IC card technology enables monetary

value to be stored relatively securely even without a large-scale computer system; (2) similarly, advances in cryptography have improved the security with which monetary value can be stored and make it realistically feasible to authenticate the identity of the counterpart and maintain the confidentiality of transmitted data; and (3) the development of the Internet and other open network systems has made it possible for ordinary consumers to make payments remotely at low cost.

Currently, several new electronic means of payment have been proposed around the world, but almost all of them use some form of a traditional bank deposit transfer and therefore do not represent completely new systems independent of the current payment system, which is centered around current accounts at the central bank. However, there are some electronic means of payment that differ markedly from traditional deposit transfer payments, for example, because they use decentralized processing in which the provider of the means of payment does not control or manage individual transactions.

The forum categorized electronic means of payment as either stored-value products or access products depending on where they store monetary value and also on the mechanisms they use for payment. Table 1 illustrates the two categories.

Table 1 Categories of Electronic Means of Payment

Electronic means of payment	
Stored-value products (i.e., electronic money)	*IC card-based products:* Effecting payment by storing electronic value in an IC card and presenting the IC card to deliver the value to a counterpart.
	Network-based (software-based) products: Effecting payment by storing electronic value in software residing on a personal computer and transmitting it over a network.
Access products	*On-line banking products:* Effecting payment through networks by issuing transfer instructions for deposit accounts.
	Credit card-based products: Effecting payment by using cryptography to transmit credit card information securely to a retailer, after which funds are moved from deposit accounts.
	Electronic checking-based products: Effecting payment through networks by sending check information electronically, after which funds are moved from deposit accounts in the same manner as if a normal check had been presented.

1. Stored-value products

Stored-value products are **a means of effecting payment electronically by storing electronic value (or the right to claim electronic value), which is electronic data issued in exchange for cash or deposits, in an IC card or personal computer software managed by the holder of funds and delivering or rewriting this electronic value to a counterpart when purchasing goods and services**.[3] It is

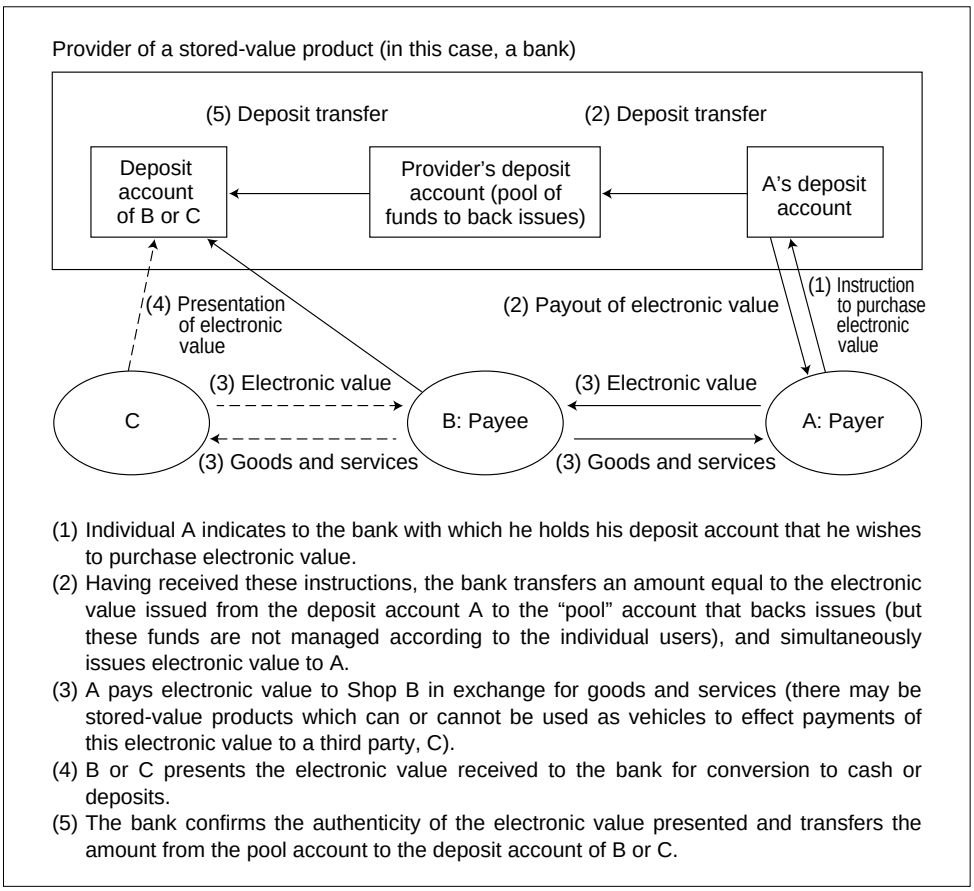
3. This report uses the term "stored-value product" in the sense that systems are designed to control data using software in an IC card or personal computer owned by the user. This may differ from the legal interpretation concerning the locus of value.

common to refer to stored-value products as electronic money, and when we use the term "electronic money" without further qualification in this report, we are referring to stored-value products.

Stored-value products can perhaps be regarded as an advanced form of the prepaid cards that have already spread, for example, as telephone calling cards. That is, they feature (1) improved security through the use of IC cards and cryptography; (2) general use not limited to specific purposes and applications; and (3) the ability to restore the principal of the electronic value on the card to cash or deposits. The term "stored-value products" is not homogenous. It refers to both products that store electronic value on IC cards and also products that store electronic value in software that resides on standard personal computers.[4]

Figure 1 contains an example of a mechanism that might be used for a stored-value product.

Figure 1 Mechanism of a Stored-Value Product (Example)



(1) Individual A indicates to the bank with which he holds his deposit account that he wishes to purchase electronic value.
(2) Having received these instructions, the bank transfers an amount equal to the electronic value issued from the deposit account A to the "pool" account that backs issues (but these funds are not managed according to the individual users), and simultaneously issues electronic value to A.
(3) A pays electronic value to Shop B in exchange for goods and services (there may be stored-value products which can or cannot be used as vehicles to effect payments of this electronic value to a third party, C).
(4) B or C presents the electronic value received to the bank for conversion to cash or deposits.
(5) The bank confirms the authenticity of the electronic value presented and transfers the amount from the pool account to the deposit account of B or C.

4. It is possible to further divide stored-value products into IC card-based products and network-based products (or software-based products in which electronic value is stored in software on a personal computer and this is used to effect payment by transmission over a network) depending on the medium used to store electronic value, but these are essentially the same in that they both store monetary value with the user.

The way in which the electronic value received in exchange for goods and services is subsequently processed will differ from product to product. Some may allow it to be used for payment to other agents (in Figure 1, the product that allowed B to use electronic value received from A to pay C) without having to convert to cash or deposits; others may require conversion (in Figure 1, the product that required B to present electronic value received from A to the issuer for conversion to deposits). The former is referred to as having transferability,[5] and it is because of these characteristics that stored-value products are said to be similar in nature to cash. However, most of the products in the pilot programs do not have transferability.

2. Access products

Access products are **an electronic means of payment that uses the Internet or other network and a standard personal computer or similar equipment to remotely issue payment instructions to a centrally processed means of payment such as a deposit transfer system. In access products, the monetary value does not reside with the user; it is always with the provider of the means of payment, that is, the bank holding the deposit account**.

One example of an access product is the service that enables consumers to issue deposit transfer instructions by means of standard low-cost personal computers and Internet connections (the on-line banking products shown in Table 1). This is really a part of the firm banking service that began to be used between large corporations and banks about 20 years ago. Thanks to advances in telecommunications and cryptography, it is now sufficiently inexpensive for it to be used by consumers and smaller businesses.

Other examples would include means of payment that utilize cryptography to enable the secure transmission of credit card numbers and expiration dates via Internet web sites (credit card-based products in Table 1), and the means of payment that enables electronic checks to be written over a network (electronic checking-based products in Table 1; these are being used on an experimental basis, mostly in the United States).

In fact, however, deposit transfers over ATMs, credit cards, and debit cards[6] are themselves means of payment that access computer centers which manage monetary value via networks from remote ATMs or terminals located in member stores. In that they make it easier to transfer funds from remote locations, these means of payment are essentially the same as more recent access products because they represent an improvement in convenience concerning deposit transfer. In other words, access products can be considered to be technologies that extend these existing means of payment.

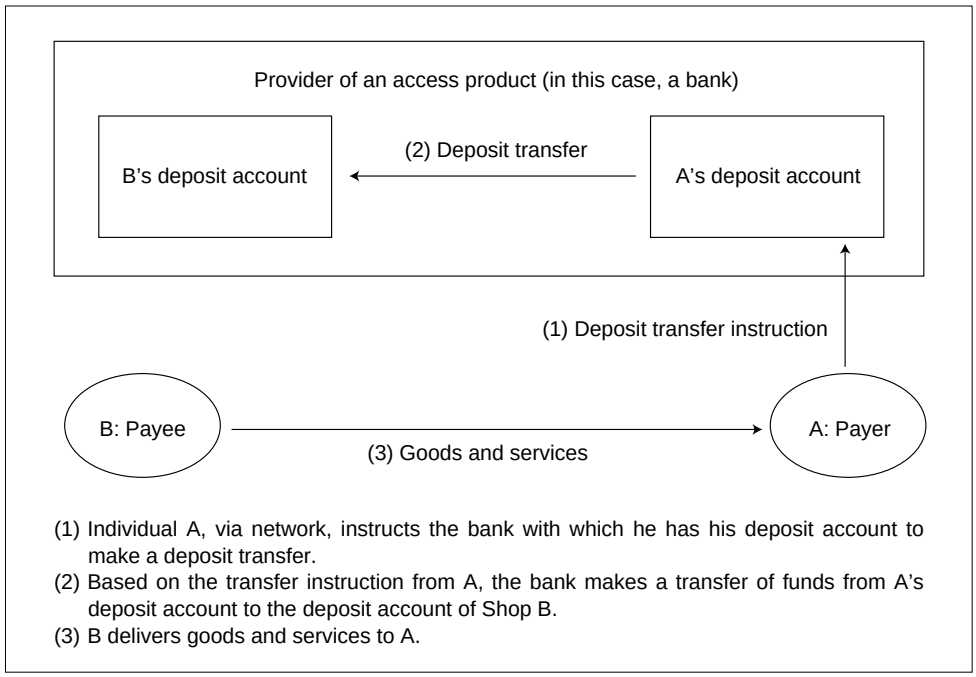
Given the progress that has been seen in technology, there could reasonably be some difference of opinion on what to treat as electronic means of payment. The BIS (1996) defines access products as "products that allow consumers to have traditional payment services by electronic means of communication (for example, use of a standard personal computer and a computer network such as the Internet to make a

5. This means that monetary value is passed from hand to hand without being returned to the issuer.
6. A card enabling the holder to have purchases directly charged to funds on his account.

credit card payment or to transmit instructions to make funds transfers between bank accounts)." It does not, therefore, include traditional deposit transfers and credit cards themselves as access products, choosing instead to focus on more recent means of payment. The forum has followed this practice in this report, where—for the sake of convenience—deposit transfers, credit cards, and debit cards, which have been in existence for a considerable period of time, are not included in the term "access products."[7]

Figure 2 gives one example of a mechanism that might be used for an access product.

Figure 2 Mechanism of an Access Product (Example)



B. Position of Electronic Means of Payment

At the present time, there is no single specific means of payment that is used in all situations. Rather, several means are used depending on the conditions involved—use is segregated. This section addresses how the various electronic means of payment are positioned in light of this segregated use. Understanding this will be valuable in grasping the position of electronic means of payment within the overall scope of economic activities.

7. To effect payments with credit cards or debit cards, a member store or user employs a closed network shut off from third parties to access the credit card issuer's database or a bank deposit account. By contrast, recent access products that transmit credit card numbers for electronic commerce purposes generally utilize the Internet, an open network that utilizes commonly available technologies and can be simultaneously accessed by third parties. Because of this, there is a greater need with the latter to maintain security with the use of cryptography and IC card technologies, for example.

1. Segregation by type of transaction

Electronic means of payment, especially access products and network-based products of stored-value products, are considered to be more suited to electronic commerce than are means of payment that involve the use of cash or other physical media. In the United States, the market for electronic commerce reached ¥1,252.5 billion[8] in fiscal 1997, a size that cannot be ignored.[9] Most of these transactions seem to be settled by electronic means of payment (access products), specifically, by inputting a credit card number and expiration date over the Internet. The domestic market for electronic commerce in Japan was only ¥81.8 billion[10] in fiscal 1997, which is far smaller than in the United States, but the growth rate was high: 2.87 times that of the previous fiscal year,[11] which indicates a distinct potential for electronic means of payment to spread as electronic commerce expands.

Pilot programs have been conducted around the world to test the use of electronic means of payment for ordinary face-to-face transactions. However, general users in those programs do not find much advantage to them other than the fact that they do not need to carry around cash. There have been scarcely any cases of electronic means of payment achieving widespread use in face-to-face transactions at this time.

It is therefore difficult at this time to determine whether electronic means of payment will be used only for electronic commerce or whether they will achieve widespread use both in electronic commerce transactions and in face-to-face transactions. This is, however, one question that must be answered in order to determine the volume position of electronic means of payment within the payment system as a whole, so it is necessary to continue monitoring the results of pilot programs closely.

2. Segregation by amount of transaction

Common practice in Japan is to use cash for small payments and credit cards for larger sums. In Europe and North America, debit cards are spreading as a means of payment for the medium level situated between cash and credit cards.

Most stored-value products are marketed as being for small-amount transactions, and statistical data from the pilot programs indicate the average value per transaction to be in the range of several hundred to around ¥2,000, which would seem to back this up.[12] The reasons for this are not only that stored-value products were developed for retail transactions that had not previously been electronic, but also that as the value of the transaction rises, so does the amount of interest lost (or opportunity cost) during the period from the time cash or deposits are converted to electronic value to the time of payment, while if these large-value transactions are settled with credit cards there are larger benefits to the one-month delay in payment. Because

8. See the Ministry of Posts and Telecommunications, ed. *White Paper Communications in Japan*, 1998.
9. While this is a small proportion of total transaction values in the U.S. retail sector (0.4 percent in 1997), an analysis by the Electronic Commerce Promotion Council of Japan (ECOM) indicates that the market will grow to 2 percent of total retail transaction values in the next three to five years.
10. See the Ministry of Posts and Telecommunications, *op. cit.*
11. Similar to the case of the United States in Footnote 9, the ratio of electronic commerce to total retail transaction values was a mere 0.05 percent in Japan in 1997, but the same ECOM analysis forecasts that it will grow to 1 percent in the next three to five years and 3.5 percent in the next five to ten years.
12. Most of the pilot programs currently being conducted place a ceiling in the tens of thousands of yen range for the amount of value that can be stored in IC cards or computer software.

of this, it seems appropriate to conclude that **stored-value products will for the foreseeable future be used primarily for small-value payments**.

For access products, the average amount per transaction will probably be higher than for stored-value products because they merely involve remote use of credit card payments and deposit transfers.

C. The Potential of Electronic Payment Technology

Electronic means of payment comprise many new technologies, and a wide range of parties is involved in it. What it will look like and how it will be used in the future will depend to a great extent on unexpected factors such as developments in information and telecommunications technology or the business strategies of individual agents. This makes it extremely difficult to arrive at any theoretical forecasts. Throughout this chapter so far, it has been assumed that the technologies and payment mechanisms do not change from what is available at the present time, and those electronic payment technologies with the greatest potential have been targeted.

However, this by itself carries the risk of misreading the medium- and long-term potential of electronic means of payment, so this section contains a broad list of the latent potential developments inherent in these means. It should go without saying that there are many directions that electronic payment technology could take in its development and it is difficult to blueprint its possible future at this stage. Rather, the development of electronic payment technology should continue to be carefully observed.

1. The spread of digital goods

When the value of a good is in its information (this report will refer to this as a "digital good"),[13] it is by nature possible to purchase and transport the good entirely on a network. It is therefore inefficient for both the producer and the consumer to use cash or other physical media just for the payments associated with commercial transactions in digital goods. While there are still many hurdles to be overcome, including the security technology required to prevent unauthorized access and the handling of copyrights on digital goods, the greater the percentage of overall economic activities accounted for by transactions in digital goods, the greater the potential for the spread of electronic means of payment.

As already discussed, most existing stored-value products have been developed so that they can be administered at low cost on condition that they will be used for small-value payments. It has been pointed out that digital goods may increase settlement of small-value transactions—the few yen that it would cost for a single news article or a single song (i.e., micro-payments). In fact, several products have emerged that are focused entirely on such micro-payments, and the availability of these products raises the possibility of expanding electronic commerce to the extremely small-value transactions that have not hitherto existed.

2. Spread of payments outside the existing interbank payment system

As discussed in Section II.B, stored-value products use decentralized processing and some of these products possess a technical capability for transferability of value.

13. Examples might include news, books, music, and financial instruments.

At the present time, however, there are in fact few cases of electronic value actually being transferred. The primary reason is probably the low degree of general acceptance of those products. If this hurdle can be cleared, however, then there could conceivably be more cases in which payments are completed by the exchange of electronic value directly between the parties involved. Even with access products, were a payment system to be organized between providers of electronic means of payment that differed from the existing interbank payment system, this system would have the potential to emerge as the main payment system. In other words, the use of electronic means of payment contains the possibility of developing payment outside the existing interbank payment system.

3. Combination with services using electronic equipment

Electronic means of payment work by exchanging electronic data, and they can therefore be easily connected with services provided by the use of electronic equipment. As examples of those services already in or close to commercial application, we would point to payments of public telephone charges, automated turnstiles in bus and train stations, and payments of expressway tolls. If high degrees of convenience can be achieved through a combination of electronic equipment and electronic means of payment, then there is a potential for widespread use of electronic means of payment.

III. The Development of Electronic Payment Technology and the Impact on Monetary Policy

This chapter considers the issues that will be raised for monetary policy by the development of electronic means of payment, including stored-value products and access products. Below is a summary of the points discussed at the forum.

Before discussing the main subjects, it should be noted that (1) when one examines the linkage between monetary policy and the real economy, it may be better to consider the impact of technological changes as a whole rather than of just one electronic payment technology,[14] and (2) central bankers and academic economists still have many points of dispute and there is no broad consensus about the transmission mechanism of monetary policy, i.e., the way in which changes in the money supply influence prices, real GDP, and other variables in the real economy. In consideration of these reservations, **this report has limited its analysis to the effects that the development of electronic payment technology are likely to have on the central bank's ability to control the money supply**.

A. Is Electronic Money Cash or Deposits?

It is crucial to clarify the stage of development of the electronic money analyzed by this report when discussing the effect of the development of electronic payment

14. For example, technological progress has a significant effect on the price concept that is the goal of monetary policy, for it will change the quality of goods and services. In this sense, the development of electronic payment technology is merely one part of a broader spectrum of technological advance, so it is necessary to rethink the concept of monetary policy itself—for example, how to select a new goal as a result of technological advances.

technology on monetary policy. If one is discussing electronic money that is merely an extension of current bank deposits and guaranteed to be exchangeable for high-powered money, the premises will markedly differ from what they will be if one is discussing electronic money issued in accordance with "Hayek's free banking,"[15] which behaves as if it were the second central bank. Therefore, this chapter begins by clarifying the development of electronic money from the viewpoint of its economic functions, so that subsequent discussions will be easier to grasp.

The opinion supported by the majority of the forum members was as follows. That is, **for the foreseeable future electronic money (stored-value products) should be considered one form of new private bank debt that can be utilized as a means of payment, and therefore its development should be viewed as the emergence of a new kind of deposit**.

For simplicity, the following discussion will refer to any company that is able to issue debt which can be used as a means of payment, as a "private bank." In other words, the concept of private bank used here includes both existing banks and companies that will enter the payment business, issuing electronic money.

It must be underscored here that electronic money is viewed only as a deposit, not as cash.[16] Certainly, electronic money is extremely similar to cash in that it enables the use of decentralized processing to settle payments between the parties involved, and in some schemes it can be transferable. However, for the foreseeable future, electronic money is unlikely to prevail widely unless it is backed by a guarantee or trust that it is fully convertible to cash (central bank debts) just as are current bank deposits.[17] Therefore, for the time being, electronic money itself will merely be a debt issued by a private bank—that is, a deposit—and will not provide the kind of finality supplied by cash and reserve deposits (i.e., debts of the central bank).[18]

That still leaves the question of how to define access products including more advanced forms of credit card and on-line banking. As noted in Chapter II, access products use electronic methods to achieve easier and quicker movements of funds through transfers of existing deposits. Therefore, **the development of access products can be considered equivalent to the emergence of a new form of deposit, in that they improve the convenience (attractiveness) of bank deposits**.

In the discussion of the impact on monetary policy from Section III.B onward, it will be understood that the emergence of electronic means of payment, whether they are stored-value products or access products, implies the emergence of new and highly convenient deposits.

15. In his work, *Denationalization of Money* (1976), Hayek argued that the monopolistic issue of nonconvertible money by the central bank should be abolished and that private banks should be given the right to issue it. Hayek's basic assertion was that competition between multiple currencies would result in the survival of the currency that could maintain the most stable purchasing power.
16. In this report, cash refers to a means of payment that completes the settlement by its transfer (that has finality). It is generally the debt of the central bank. By contrast, deposits, which are private bank debts, do not by themselves have finality. They usually become means of payments only when their convertibility to cash is guaranteed.
17. If this conversion is into not yen but U.S. dollars or another foreign currency, then the phenomenon will be regarded as dollarization.
18. However, one cannot completely disregard the possibility that electronic money will come to have a finality similar to cash, i.e., that it will circulate as a nonconvertible currency. We consider this possibility further in Section III.E.

B. The Development of Electronic Payment Technology and Credit Creation

In considering the effect that the development of electronic payment technology will have on the central bank's ability to control the money supply, one must address the question of how the traditional credit creation process that currently relies only on existing bank deposits will be changed.

1. The development of electronic payment technology and the rise in the money multiplier

Using the simple money multiplier theory, it is easy to understand that an increase in electronic money stock[19] will raise the money multiplier.[20] This result is entirely natural, as long as electronic money is considered to be a substitute for existing cash and deposits and not subject to statutory reserve requirements.[21] What is more, in the world of textbook-style money multiplier analysis, an increase in the money multiplier itself is not essentially a problem. The theoretical conclusion for monetary policy after the spread of electronic money would merely be that "the accelerator pedal is more sensitive, so you need to press lightly." However, the forum also noted the following problems with this rather simple conclusion.

First, **the money multiplier will probably be more unstable during the development of electronic money than now**. Even though the money multiplier has always been unstable, its movements have been cyclical in nature. But as electronic money spreads, an upward shift will be added. Therefore, in the process of the development to prevalence of electronic money, it will be more difficult to predict the movements of the money multiplier, and this could make it less relevant in controlling the money supply through high-powered money.

The second problem concerns the nature of the credit on the asset side of electronic money issuers. In the simple money multiplier analysis of Appendix, it is implicitly assumed that there will be no distinction between the credit supplied by traditional banks and credit supplied by the issuers of electronic money. However, it is certainly possible that there will be substantial differences between the two. Based on the report published in June 1998 by the Financial System Research Council's Study Group on an Environment for Electronic Money and Electronic Payments, the government is supposed to obligate segregated management of the funds backing electronic money and the investment of the funds in safe, liquid assets. If these regulations are actually imposed in the future, then it would be appropriate to distinguish between the assets of banks that lend to relatively high-risk clients, including smaller businesses, and the assets held by electronic money issuers. Therefore, we will need to closely observe the contents of the assets held by the issuers of electronic means of payment.

19. Our discussion here has stored-value products in mind in order to distinguish electronic money from conventional bank deposits. However, the discussion below would remain the same, even if access products not subject to statutory reserve requirements were substituted for stored-value products.
20. For details, see the Appendix.
21. It is unrealistic to think that issuers of electronic money would hold absolutely no reserves because they need not have statutory reserve requirements. As long as electronic money is a new kind of deposit, its issuers will hold reserves against payments and withdrawals. It is important that the issuers of electronic money will probably be able to save on their reserve holdings compared to traditional banks. This point becomes extremely important in subsequent discussions of how high the money multiplier will rise.

Thirdly, the question is how far the money multiplier can rise. In an extreme case in which the money multiplier was able to rise virtually infinitely, there would be grave doubts that monetary policy could maintain its effectiveness. We therefore analyzed in detail the potential for an infinite rise in the money multiplier as a result of the broad spread of electronic means of payment.

2. Credit creation through the issue of electronic money

It is well known that, in the case of credit creation through conventional bank deposits, the reserves supplied by the central bank function as an "anchor" for the control of the money supply. When credit is created through the issue of electronic money, however, there will be no required reserve deposits to function as the anchor. So there might be a concern that the electronic money issuer could continue to increase lending and the money multiplier could reach infinity.[22] The conclusion reached at the forum on this issue was that **it would be unlikely that electronic money issuers would continue to increase lending infinitely**. There are four major reasons for this conclusion.

First, as already described, even if electronic money were not subject to statutory reserve requirements, it is highly likely that issuers would hold either cash or bank deposits as reserves against payments and withdrawals. Though electronic money issuers would certainly be able to save on their reserves compared to traditional banks, it is unrealistic that they would reduce them to absolutely nothing.

The second reason is the existence of "leakage." Even assuming that issuers of electronic money could hold absolutely no reserves, it is unrealistic to think that in the credit creation process through electronic money the funds would continue to circulate forever among the electronic money issuers. The electronic money stock received by people would at least in part be converted to cash and bank deposits and therefore "leak out" of the electronic money issuers.

Third, the finite nature of lending demand should be noted. Even in the process of credit creation through electronic money there must be borrowers. And, obviously, electronic money issuers will not have unlimited opportunities to lend to "good" borrowers. In other words, the lending demand curve the electronic money issuers confront will be similar to the demand curve banks face: it will move downward to the right against an interest rate and it will be finite.[23]

Finally, the costs incurred by electronic money issuers in supplying lending are important. When electronic money issuers make loans, they will incur administrative costs just as traditional banks do currently. Therefore, the lending supply curve of the electronic money issuers will be similar to the lending supply curve of banks: it is a finite curve that rises to the right.

22. More specifically, there is a concern that even though real GDP is constrained by the potential GDP and cannot rise beyond it, electronic money issuers could continue to increase lending infinitely and thereby cause inflation. With traditional bank lendings and deposits, tight monetary policies can be implemented to prevent such a situation from occurring through the reserves supplied by the central bank function as an anchor (although there is some dispute as to whether a central bank controls the volume of reserves or the call rate). But this is not the case with electronic money.
23. For more details on this point see Tobin, J., "Commercial Banks and Creators of Money," in D. Carson, ed. *Banking and Monetary Studies* (Homewood: Irwin, 1963).

These ideas are certainly nothing new to electronic money. When Euro-deposits emerged, Milton Friedman argued that the "Euro multiplier"[24] would be extraordinarily high because Euro-deposits were not subject to statutory reserve requirements. However, there seems now to be a consensus among academic economists that the Euro multiplier is not as big as was believed, because (1) Euro-deposits have an extremely low redeposit rate (there is a large amount of "leakage" from Euro-banks), and (2) Euro-banks have considerable domestic bank deposits as reserves against payments and withdrawal.[25] This is similar to the arguments presented above for electronic money.

C. Electronic Payment Technology and the Money Demand Function

The previous section explained the impact of the development of electronic payment technology on money supply. On the other hand, this section examines its impact on money demand.

1. The development of electronic payment technology and the money demand function

As noted, money has three important functions: (1) a unit of account, (2) a medium of exchange, and (3) a means of storing value. Electronic means of payment will primarily provide the second function. Therefore, when considering the impact of electronic payment technology on money demand, it is appropriate to utilize a money demand model based on transaction motives. According to the leading model of this type, the Tobin-Baumol model, there is a positive correlation between the cost of converting deposits into cash and the cash demand balance.[26] The development of electronic payment technology will reduce the costs incurred in converting deposits into cash,[27] and therefore reduce the demand for cash stock. Intuitively, it would seem that the reduction in the cost of traveling to and from the bank would make it possible to convert from deposits to cash more frequently, and therefore reduce the balance of non-interest-earning cash.

The Tobin-Baumol model considered here is merely a model of the demand for cash (narrowly defined money), but it can be applied to a rather wider range of financial assets. In other words, exactly the same argument could be made if the relationship between cash and deposits is replaced by the relationship between broadly defined money (cash and deposits) and nonmonetary financial assets (bonds and stocks). Advances in information technology, although they do not merely mean electronic payment technology, would conceivably reduce the cost of converting

24. Assuming the domestic bank deposits held by Euro-banks to be reserves, the Euro multiplier equals the Euro-deposit balance divided by reserves.
25. Several empirical studies show the Euro multiplier to be a relatively low 1.05–1.21. For more details, see, for example, Niehans, J., *International Monetary Economics* (Johns Hopkins University Press, 1984), Chapter 9.
26. See Baumol, W., "The Transactions Demand for Cash: An Inventory Theoretic Approach," *Quarterly Journal of Economics*, 67 (4), November 1952, pp. 545–556, and Tobin, J., "The Interest Elasticity of Transactions Demand for Cash," *Review of Economics and Statistics*, 38 (3), August 1956, pp. 241–247, for an explanation of the Tobin-Baumol model.
27. It is easy to understand this if one imagines an electronic means of payment that allows one to access one's deposit account through the Internet from a personal computer at home and download monetary value into an IC card on hand. One would be spared the trouble of going to and from the bank, and unlike the withdrawal of bank notes from an ATM, one need not carry a bulging wallet home. Therefore, both handling and security costs of electronic means of payment would be simultaneously reduced.

between these assets and broadly defined money, so demand for broadly defined money would also decline. Either way, a money demand model based on transaction motives indicates that **the spread of electronic payment technology will enable users to save their money demand balances**.

2. Monetary policy targets under the circumstances of the development of electronic payment technology

The report has so far examined the impact of electronic payment technology on the money supply and money demand at the macro level. In addition, it must be considered whether central banks will be able to accurately observe the shifts in the money multiplier and money demand function that will occur in the process of the development of electronic payment technology. It is probably appropriate to assume that, during this process, shifts of both the money multiplier and the money demand function will occur as "unexpected" shocks by the central bank.[28] If this is indeed the case, then the following question needs to be answered: What target should a central bank choose to stabilize the macroeconomy during the process of development of electronic payment technology in which unexpected financial shocks occur frequently?

Macroeconomics has already provided a clear answer to this question. Poole (1970)[29] uses an IS-LM model to develop the following argument. If the major factor in an economic fluctuation is a real (IS) shock, then stabilization of the money supply will be a better policy to minimize the amplitude of real GDP fluctuation than the stabilization of interest rates. Conversely, if a portfolio (LM) shock, for example, a shift of the money demand function, is greater, then stabilization of interest rates will be more effective than stabilization of the money supply in reducing the fluctuation of real GDP. Based on Poole's analysis, therefore, **if unexpected shocks to the money multiplier and money demand function due to the development of electronic payment technology occur frequently, then it will be desirable to choose interest rate stabilization policies**.[30]

28. This tendency toward financial instability such as the shift of the money demand function does not become apparent until the emergence of electronic payment technology. Many academic economists and central bankers have argued that advances in financial innovations and deregulation in the 1980s destabilized money demand functions in the developed countries.
29. See Poole, W., "Optimal Choice of Monetary Policy Instruments in a Simple Stochastic Macro Model," *Quarterly Journal of Economics*, 84 (2), May 1970, pp. 197–216.
30. In a different context from Poole, M. Woodford's paper, "Doing without Money: Controlling Inflation in a Post-Monetary World" (NBER Working Paper No. 6188, 1997) provides a model showing that even when technological advances have reduced the demand for money to near zero, the central bank will still be able to consistently control the inflation rate using interest rate policies.

Box 1 The Spread of Mutual Funds in the United States and Its Impact on Monetary Aggregates

As has already been noted, the report by the Financial System Research Council's Study Group on an Environment for Electronic Money and Electronic Payments suggests the possibility of obligating the issuers of stored-value products (electronic money) to invest the money backing these instruments in safe, liquid assets—for example, government bonds and assets of similar quality. Given the fact that the asset side of electronic money issuers will be invested in bonds rather than traditional bank lending, the spread of electronic money can be expected to have an effect similar to the spread of MMF accounts and other mutual funds.[31] In order to consider the effect of the spread of electronic money on monetary aggregates, let us introduce the paper presented at the forum by Itoh, Kawamoto, and Taniguchi (1999), which analyzes the effect of the spread of mutual funds on money supply in the United States.

Between 1990 and 1993, the U.S. Federal Reserve Board (FRB) eased the stance of monetary policy continuously, but the M2 growth rate failed to increase while the bond and stock mutual funds held by the household sector grew at a historically high rate. This phenomenon led many economists, especially those at the Federal Reserve banks, to attempt to estimate broadly defined monetary aggregates that included bond and stock mutual funds. They have carried out many empirical studies to investigate whether such aggregates could be used in place of existing M2.[32] Below are some of the most notable findings.

First, the relationship between the broad monetary aggregates including mutual funds and the real economy is crucial for the FRB. For example, Orphanides, Reid, and Small (1994) create a broadly defined monetary aggregate that includes bond and stock mutual funds, but their empirical test shows that it is not necessarily superior to existing M2 as a leading indicator of nominal GDP in the 1990s.

Second, the question of how to include foreign-currency assets in broad monetary aggregates should be noted. While the money supply statistics are currently denominated entirely in U.S. dollars, among the most rapidly growing funds in the 1990s were those invested in foreign-currency

31. Some forum members were of the opinion that the electronic money in the report of the Financial System Research Council's Study Group on an Environment for Electronic Money and Electronic Payments was virtually considered "MMF accounts with payment functions," and that whether the instruments were electronic or not was not an essential issue in the report.

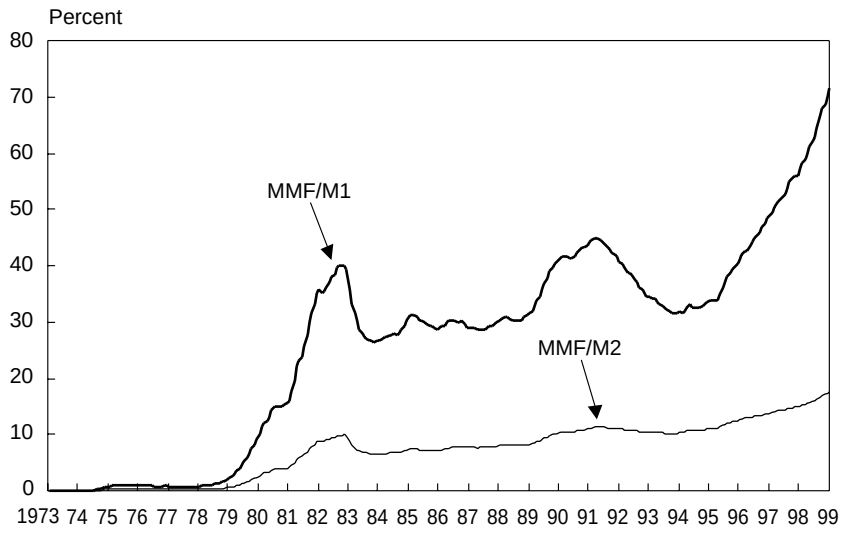
32. As is well known, MMF accounts emerged in the 1970s when deposit ceiling rates were regulated by Regulation Q. Because of high inflation rates and high money market rates caused by the FRB's tightening, MMFs rapidly became an attractive substitute to bank deposits. Thus, personal MMF accounts were added to M2 when the FRB reviewed monetary aggregates in 1980. We should draw attention to the fact that, in the 1990s, the argument is whether to include mutual funds excluding MMF accounts in the component assets of M2. We would also note that the Bank of Japan (BOJ) does not at present include any investment trusts (or MMFs) as component assets of M2.

denominated assets. This raises previously unexplored issues such as how to handle foreign exchange rates when creating monetary aggregates that include mutual funds.

The third question is whether the principal of the assets constituting monetary aggregates is guaranteed. Current M2 includes only safe assets for which the principal is guaranteed (i.e., assets whose prices do not change according to market interest rate levels). However, the prices of bond and stock mutual funds vary greatly as a result of the capital gains and capital losses brought about by interest rate movements. The appropriate estimation of the monetary aggregates that include these mutual funds is far more difficult than that of existing M2 (Collins and Edwards [1994]).

Finally, Itoh, Kawamoto, and Taniguchi (1999) raised the issue of "moneyness."[33] Though bond and stock mutual funds are used as a means of payment, their low turnover rates (defined as the ratio of total payment amounts to assets on balance) indicate that they have far less "moneyness" than existing bank deposits. Therefore, it may not be rational to include them in M2 with the same treatment as component assets of current M2. One proposal for overcoming this problem is to switch from the current simple arithmetical aggregation to a weighted aggregation (weighted for the moneyness of the financial asset).[34]

Ratio of MMF Assets to M1 and M2 in the United States



33. Generally, "moneyness" means the degree to which a financial asset serves as a medium of exchange.
34. Feldstein and Stock (1994) is one such attempt.

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Itoh, M., T. Kawamoto, and F. Taniguchi, "MMFs and Electronic Money," IMES Discussion Paper Series No. 99-J-21, Institute for Monetary and Economic Studies, Bank of Japan, 1999 (in Japanese).

Orphanides, A., B. Reid, and D.H. Small, "The Empirical Properties of a Monetary Aggregate That Adds Bond and Stock Funds to M2," paper presented at the Federal Reserve Bank of Saint Louis Symposium on Mutual Funds and Monetary Aggregates, March 1994.

Box 2 The Spread of Credit Cards and Monetary Policy

As already noted, when purchasing commodities through the Internet by credit card, one will have only to input the credit card number and expiration date. The development of access technologies, therefore, will probably make credit cards even more convenient than before. In this box, we examine how the spread of credit cards (the increase in the outstanding balance of credit card loans and in the volume of settlements by credit card) owing to the development of access technologies will affect monetary policy, following Ito, Kawamoto, and Taniguchi (1999).

The most important characteristic of credit cards that is significantly different from other means of payment is that they allow credit card holders free and unsecured borrowing within a preset credit limit. This can lead consumers to mitigate liquidity constraints.[35] Generally, if some economic agents are under liquidity constraints, monetary policy could affect their intertemporal allocation of resources, by tightening or easing liquidity (this is called the "availability channel"). However, the widespread use of credit cards may mitigate liquidity constraints of consumers to the point that this availability channel would lose its effectiveness.

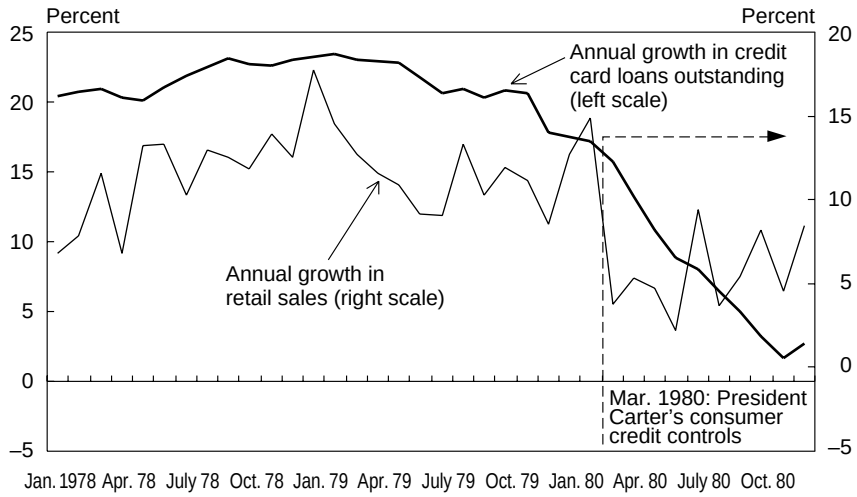
The situation in the United States in the early 1980s provides a good case study of the degree to which the effect of credit cards on consumers' liquidity constraints is important. Partly because of the second oil crisis, high inflation rates beginning in the late 1970s had persisted into the early 1980s in the United States. In March 1980, President Carter gave the FRB special authority to implement credit controls in order to overcome the inflation. With the strong leadership of then-Chairman Volcker, the FRB imposed a special 15 percent reserve requirement on credit card lending, along with an array of other

35. As is well known, the existence of liquidity constraints tends to push national savings rates higher. According to empirical analyses using cross-country data, the national savings rates in countries in which consumers can

draconian regulations to restrict consumer credit. The effect was enough to sharply curtail consumer credit card borrowing. During the April–June quarter of 1980, consumer spending declined by 9.8 percent in annualized terms from the previous quarter (for durable goods, the decline was 43.2 percent). This was the sharpest quarterly decline in the postwar period[36] (see the figure below). Later, in July and subsequent months, credit controls were gradually phased out and consumption recovered. This experience can be interpreted as evidence that credit cards do indeed play a significant role in mitigating consumers' liquidity constraints.

Another important feature of credit cards is that they can concentrate payments at a prearranged time. This reduces the uncertainties involved in making payments and has the effect of reducing the precautionary demand for money. If the central bank accommodates this decline in money demand, then income velocity rises. In fact, in the late 1980s in Switzerland, where both debit cards and credit cards had become widespread, the income velocity of narrow money (base money and M1) rose markedly (see the figure below).

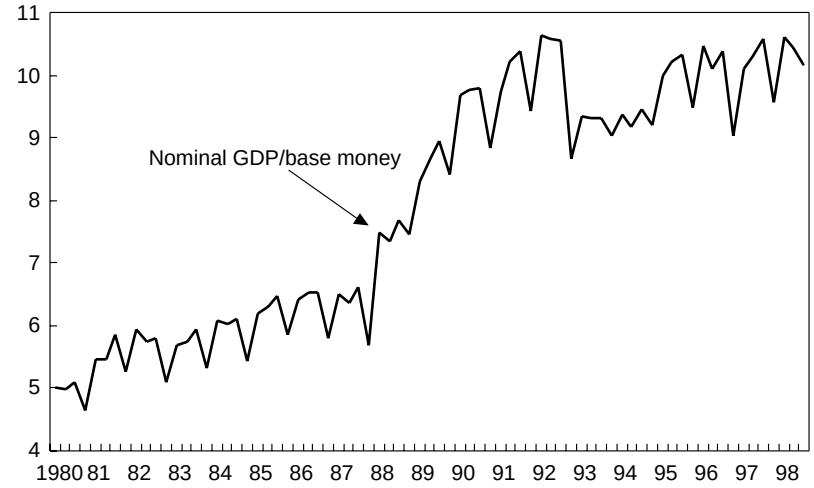
Credit Card Loan and Retail Sales in the United States, Late 1970s/Early 1980s

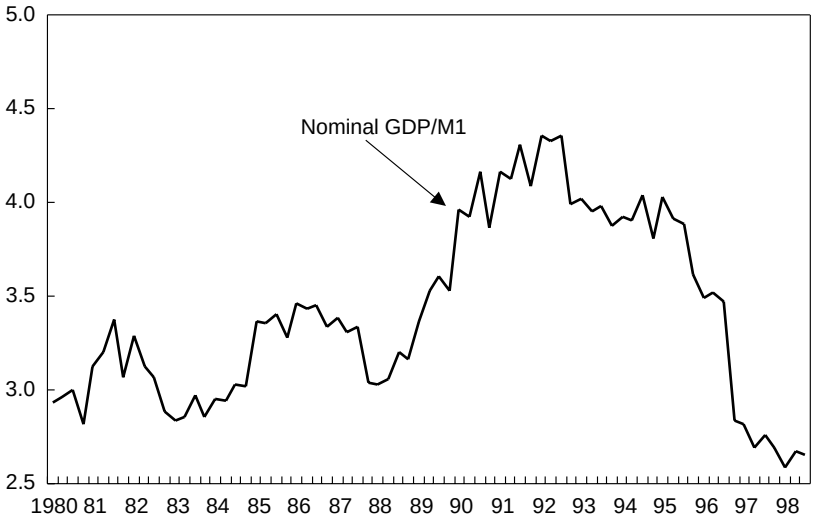


sufficiently make use of borrowings via credit cards are significantly lower than in countries where consumer credits are not readily available. (See, for example, Jappelli and Pagano [1994].) Obviously, credit cards will ease consumers' liquidity constraints, but in Japan the percentage of revolving payments is not so high, and the credit period is relatively short, so some members of the forum argued that in fact credit cards only played a role of smoothing seasonality out.

36. Obviously, other factors besides the FRB liquidity controls caused consumption to sharply drop—for example, the decline in consumers' net incomes as a result of the recession.

Swiss Income Velocities of Narrow Money





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Jappelli, T., and M. Pagano, "Saving, Growth, and Liquidity Constraints," *Quarterly Journal of Economics*, 109, 1994, pp. 83–109.

D. The Development in Electronic Payment Technologies and the Impact on Market Operation and the Reserve Requirement System

The money multiplier formula that describes the relationship between the money supply and high-powered money is an identity equation, so it always holds true. However, the money multiplier only represents a predefined, accounting relationship and cannot necessarily show causality from high-powered money to money supply. According to the textbook theory of bank behavior, the most important factor determining the movement of the money supply is the extension of credit by banks and other private financial institutions.[37,38] To take up bank lending as an example of bank credit extensions, the bank will decide how much to lend so as to maximize its own profits. The variable that influences the bank's profits is the difference (spread) between the lending interest rate and the call rate. In other words, a rise in the call rate, which is the cost of lending to the bank, will decrease the amount of bank lending. The converse is also true. In either case, in this model, once the amount of lending is determined, the amount of deposits and also the money supply will be determined as well.[39] At the same time, the amount of reserves required will also be determined, so the demand for high-powered money will be determined in conjunction with the demand for cash. At each point in time, the central bank must meet the demand for high-powered money in order to avoid turmoil in the financial markets. However, the central bank can also set the level of the call rate at which private banks lend reserves to each other by the way in which it supplies high-powered money. Ordinarily, the call rate will have a substantial impact on the lending activities of private financial institutions, so the central bank is ultimately able to have an impact on the money supply as well, according to this kind of model.

In practice, Japan and most other countries use short-term interest rates (money market rate for overnight loans) to pursue monetary policy (during ordinary times) as control variables. We therefore need to consider what impact the spread of electronic payment technology will have on the central bank's ability to influence short-term interest rates, and what kinds of policy, including the potential need for modifications to the reserve requirement system, should be implemented. In order to tackle these questions, it will be important to elucidate beforehand the impact that electronic payment technology will have on (1) the demand for reserves at financial institutions, and (2) the ability of the central bank to supply reserves.

1. Impact on the demand for reserves

If electronic means of payment are merely a substitute for cash, then their effect on market operation will be comparatively slight. That is because central banks, in practice, passively satisfy the demand for cash, and market operation is conducted to influence the level of the reserve. On the other hand, the spread of electronic payment technologies will promote a shift away from the deposits that are subject to

37. Extension of credit in this context includes bank purchases of bonds and equities as well as ordinary lending.
38. No matter how many transfers there are between personal deposits, from a macro standpoint it is just a transfer. If there are no extensions of credit by the banking sector, then there is no change in the total amount of deposits.
39. Other factors in addition to lending that would change the money supply are rather technical in nature and have thus been omitted from this discussion.

the current reserve requirement system to electronic means of payment that are not subject to such a requirement. The demand for reserves is therefore likely to decline.

However, what is important in a central bank's control over short-term interest rates is not the size of reserve demand in absolute terms but that the demand for reserves be stable and predictable. Even when required reserves are at zero, it is possible to control short-term interest rates as long as financial institutions need to hold stable balances in their accounts with the central bank in order to effect final payment. This is justified by the experiences of central banks in Canada and other countries. Therefore, even after electronic payment technologies that substitute for deposits have spread, what will be ultimately important is whether final payments among private financial institutions, including the issuers of electronic money, are conducted stably through their current accounts with the central bank. This is a question that needs to be examined more broadly, including the influence that the spread of electronic payment technologies will have on the existing bank-oriented payment systems centered around central banks.

2. Impact on the supply of reserves

The impact on the supply of reserves will to a great extent depend on how the spread of electronic payment technologies affects the balance sheets of central banks. Cash is the largest liability item for a central bank. So if electronic means of payment are broadly used as substitutes for cash, then it is highly likely that a central bank's balance sheet will shrink substantially.[40] The question is how far its balance sheet needs to shrink before it begins to serve as a constraint on the central bank's ability to supply reserves. For example, in everyday open market operations, whose scale is relatively small, even a fairly small central bank's balance sheet would not be that much of an impediment, but if for some reason the central bank needed to engage in operations to absorb a large amount of reserves,[41] it would not have enough salable assets and therefore would be potentially unable to achieve its expected objectives (the BIS [1996]).[42]

3. What kind of policies should be adopted?

Several policies were proposed at the forum to solve the market operation issues posed by the spread of electronic payment technologies.

The first proposal would be to impose reserve requirements on all payment-styled financial instruments including electronic means of payment, and to set the same reserve ratios for all of them.[43] This policy can be expected to maintain stable reserve demand of private financial institutions. In addition, because all payment-styled financial instruments would be subject to the same reserve ratio, the distortions to resource allocation derived from the reserve system would be minimized, and fairness would be ensured for financial institutions offering payment service. We should also

40. See Section III.E for the effect that the contraction of the central bank's balance sheet will have on seigniorage revenue.
41. For example, there could be operations for the purpose of neutralizing intervention to purchase foreign currency on the foreign exchange markets.
42. Some members of the forum pointed out that the sales of commercial bills currently engaged in by the Bank of Japan could be used for these sorts of problems.
43. A more practical issue is the difficulty in specification of payment-oriented financial products.

note that it is worth considering the payment of interest on reserves to eliminate in advance any incentive for private financial institutions to avoid reserve burdens.[44]

The second proposal is to reduce the reserve ratio for all financial instruments to zero (move to a zero reserve regime). In other words, as long as there continues to be stable demand for payments through central bank current accounts even after the spread of electronic payment technologies,[45] market operation will still be effective even with reserve ratios dropped to zero. Zero reserve ratios would also potentially minimize the disadvantages from the reserve requirements.

The third proposal is for the central bank itself to issue electronic money. There is deep-rooted opposition to this. Opponents argue that it would constrain competition among financial institutions and therefore reduce the incentives to private-sector innovation in electronic payment technologies.[46] It is also uncertain how much impact the central bank would have on the spread of private electronic money even if it were to enter the electronic money business. Forum members differed on whether the current general acceptance of Bank of Japan notes stemmed from the fact that they are legal tender, "esthetic" reasons related to their form and feel, or the spread of ATMs. If it is only because ATMs are readily available, then this is merely a technology problem. If esthetic issues are involved, then the problems become more complex. In either case, it may be technically feasible for the central bank to issue electronic money, but the pros and cons require careful consideration.

E. The Impact of Electronic Payment Technology on Central Bank Seigniorage

1. The development of electronic payment technology and central bank seigniorage

The term "central bank seigniorage" often causes confusion because it is used in various senses. We therefore begin by defining it.

In economics textbooks, seigniorage ordinarily means "inflation tax," which is defined as the quantity of real purchases per unit time that the government finances from additional issue of money. That is, it equals the increase in nominal high-powered money stock per unit time (ΔH) divided by the current price level (P). This can also be expressed as the rate of increase in nominal high-powered money stock ($\Delta H/H$) multiplied by the real high-powered money balance (H/P). For the sake of convenience, we will refer to this as narrowly defined seigniorage. By definition, narrowly defined seigniorage can only take place for agents that are able to cause inflation by increasing their own liabilities. Therefore, these agents should be confined to the government and central bank.[47]

44. There is some concern that when market interest rates are paid on reserve deposit balances and interest is also paid on the TBs and FBs used in operations, even the market operation to exchange reserve deposits for TBs and FBs and vice versa may not be able to influence interest rates and money (think, for example, of a Tobin-styled general equilibrium model of asset markets). But some members of the forum argued that even if interest were paid on high-powered money, it would be unrealistic to think that other financial assets would be fully substitutable for it.
45. In order to produce stable demand for payments through central bank current accounts, it may be necessary for some sort of legal compulsion that requires issuers of electronic means of payment to make final settlement though central bank current accounts.
46. See, for example, the BIS (1996).
47. Strictly speaking, the reason why narrowly defined seigniorage is called an inflation tax is because the rate of increase in high-powered money stock ($\Delta H/H$) is, in the long run, equal to the inflation rate ($\Delta P/P$). For a more

In the actual balance sheet of a central bank, the liabilities side generally is made up of banknotes issued at zero interest, while the assets side consists of interest-bearing securities, for example, government bonds. Therefore, the central bank could gain profit from the difference between asset and liability interest rates. This sort of profit is one of the central bank's major sources of income, and it is often regarded as the component of broadly defined seigniorage. However, the profit arising from the difference between asset and liability interest rates does not accrue only at the central bank. Obviously, private banks can also earn it. Therefore, it is extremely important to distinguish between narrowly defined seigniorage and broadly defined seigniorage when discussing the impact of the spread of electronic payment technologies on central bank profit.

If stored-value products are largely substituted for cash, then the central bank's balance sheet will contract and therefore the central bank's profit arising from the difference between these interest rates will decrease. However, as stated by the BIS (1996), these profits are usually far larger than the central bank's running expenses, so even a substantial decrease in profit is unlikely to put the central bank in a situation in which it is unable to cover its costs.[48,49]

Certainly, the profit arising from the difference between the interest rates on assets and liabilities will be transferred from the central bank to the issuers of electronic money, but this does not at all mean that electronic money issuers will gain narrowly defined seigniorage. As discussed in Section III.A, even electronic money that is highly substitutable for cash will not become inconvertible money (by itself it will not have finality), and therefore it can be considered a deposit. Putting it differently, electronic money issuers will not be able to increase their own liabilities on their own and cause inflation for the economy as a whole. Therefore, just as traditional private banks do not gain narrowly defined seigniorage, neither will electronic money issuers. Traditional banks and electronic money issuers will merely earn their profits arising from the difference between the interest rates on assets and liabilities, according to the size of their balance sheets.

2. Could electronic money be inconvertible money?

Is there any possibility that electronic money could circulate as an inconvertible money? In general, the issuers of electronic money can be regarded as private firms that behave so as to maximize their profits. It should be noted that as long as electronic money issuers behave in this way, they will always have incentives to cause "dynamic inconsistencies." In other words, they may try to gain the trust of the public by announcing how much electronic money they will issue, but will have an incentive to break their word and increase the amount of electronic money they

detailed discussion of this point, see, for example, O. Blanchard and S. Fisher, *Lectures on Macroeconomics*, MIT Press, 1989, pp. 195–201.

48. According to the BIS (1996), the profit of the Bank of Japan in 1994 was equivalent to 0.42 percent of GDP, while the Bank's current expenses were only 0.06 percent. Therefore, the percentage reduction of cash balance that would bring the profit down to the breakeven point (the percentage of cash balance to be reduced in order to make the profit equal to the current expense) is equivalent to 85 percent.
49. According to the BIS (1996), if central banks were unable to cover expenses by (broadly defined) seigniorage and therefore became fiscally dependent on the government, their fiscal independence of monetary policy implementation might be impaired.

issue, so as to earn more profits. In this case, electronic money issuers should be regarded as economic agents incapable of "commitment." Therefore, it is extremely unlikely that private issuers of electronic money could circulate their liabilities as inconvertible money and benefit from narrowly defined seigniorage.

The above theoretical discussion suggests that it would be generally impossible for economic agents other than the government and central bank to circulate their liabilities as inconvertible money. This conclusion may not always be correct, however. In fact, there are some historical cases where private agents were able to succeed in committing so that they could circulate inconvertible money. Probably the most famous example is the money of Yap Island.[50] Another example is *Yamada hagaki* in Japan.[51] Both are examples of currencies created voluntarily by the private sector rather than the government.[52] In particular, the *Yamada hagaki*, Japan's oldest paper money, was able to maintain a stable value for a prolonged period of time. It was not backed by regional government authority, such as the feudal clan (*han*).

There are three conditions that must be met before something achieves widespread use as money. First, it must be sufficiently durable. Second, it must be of even, consistent quality. And third, it must be divisible. Money with these features has, over the centuries, evolved from gold ore to gold coin, and then on to paper money. But there was no clear consensus among the forum members on whether currency would shift from "paper" to "electrons," and whether this electronic money had the possibility of circulating as inconvertible money, so further consideration of these questions is required.

50. The Pacific island of Yap circulated some kind of intermediate between goods and inconvertible money. The traditional means of payment was called the *fei*, a large, rounded stone with a hole through its center, through which a rod was inserted for transportation. The stones were used as a means of exchange. However, the costs incurred in carrying large stones were so great that the islanders began to use claims against the stone currency as their money. Even if a storm blew such a stone into the ocean and it could not be recovered, the claim against the stone continued to be valid for exchange.
51. The oldest paper money to have circulated in Japan, originating in the Ise Yamada region (modern-day Ise City in Mie Prefecture), the *Yamada hagaki* was a private bill issued in lieu of change as a deposit (bill) of small amounts of silver coins used as a unit of account. *Hagaki* means "a writing of odd amounts." The issuers were priests serving at the shrine at Ise, and this self-governing organization set up an issuing system that achieved a high degree of trust and confidence among the people of the Yamada region, so that the bills were fairly widely circulated.
52. Some members of the forum noted that, since the establishment of modern central banks, there had been no widespread use of inconvertible money issued by private agents, at least not in peacetime.

Box 3 The Payment System Using Government Bond Investment Trusts and the Potential for Electronic Payment Technology

"Payment" is the conduct of transferring assets among the parties concerned, to settle the credit/liability relationship generated by transactions of goods, services, and assets. Theoretically, the assets transferred should not be confined to cash or deposits. As long as any asset or its ownership other than cash or deposits is generally acceptable, then it is quite possible to settle transactions by the asset. Itoh, Kawamoto, and Taniguchi (1999) (a paper prepared for the seventh meeting of the forum) discuss the payment system that would use not cash or deposits but government bond trusts, following Itoh and Yanagawa (1991).[53] The summary of this paper is as follows.

Like a normal investment trust, the function of financial institutions discussed here would be to purchase government bonds on behalf of customers, hold them in custody, and provide the customers with passbooks noting ownership. For example, assume that both Consumer A and Shop B have government bond fund accounts. When Consumer A purchases a good at Shop B, settlement can be completed with a transfer from the account of A to that of B. That is, the government bond fund balance of Consumer A would be reduced by the price of the good, and the balance of Shop B would be increased by the same amount. Thus, the above payment system using government bond investment trusts could provide virtually identical payment services to those now provided by bank deposits.[54]

However, there are some differences between a payment system based on government bond investment trusts and a system based on bank deposits. The biggest difference from the perspective of monetary policy is whether or not there would exist demand for high-powered money to finalize settlements. As is well known, payments with bank deposits are finalized by transfers between the current accounts that individual banks hold at the central bank. This process necessarily generates some demand for high-powered money to finalize payments, and therefore enables the central bank to control the money stock by supplying reserves (regardless of whether central bank controls the volume of high-powered money or controls short-term interest rates). On the other hand, in a payment system that uses government bond investment trusts, the parties concerned, including financial institutions, complete payments by transferring (the ownership of) government bonds without incurring credit risks. In this case, there is absolutely no demand for high-powered money to complete payment. It is therefore likely that monetary policy through supplying reserves would lose its effectiveness.[55]

53. It should be noted that the government bond trust-based payment system discussed here is merely hypothetical in nature. It is another question whether such a system would be feasible from a business standpoint.
54. Note that the payment services currently supplied by MMFs merely play a role of easily converting from the account to cash and deposits. They by no means transfer ownership of government bonds among holders directly.
55. Assuming that all payments were conducted by transfers of government bond accounts, the money supply would be determined by the volume of government bond stock and would therefore be beyond the central bank's control. In such cases, it would be fiscal policy rather than monetary policy that determined the long-term price level.

According to Wallace (1983), there are two main reasons why government bonds themselves and government bond investment trusts are not used as means of payment. The first is the existence of legal restrictions preventing the direct transfer of government bonds and the issue of private banknotes backed by government bonds. The second is that the units in which government bonds are issued are too large to settle small unit accounts. But Itoh, Kawamoto, and Taniguchi (1999) provide no clear answer on whether a government bond investment trust-based payment system like the one described above could actually emerge, when all legal restrictions are removed and electronic payment technologies have developed[56] to enable transfer of a small amount of government bonds.

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Makinen, G., and T. Woodward, "Some Anecdotal Evidence Relating to the Legal Restrictions Theory of the Demand for Money," *Journal of Political Economy*, 94 (2), 1986, pp. 260–265.

Wallace, N., "A Legal Restrictions Theory of the Demand for Money and the Role of Monetary Policy," *Quarterly Review*, Federal Reserve Bank of Minneapolis, 1983, pp. 1–7.

IV. Electronic Payment Technology and Cross-Border Transactions

It is sometimes pointed out that an electronic means of payment completes settlement just by exchanging electronic data and might therefore be expected to increase cross-border electronic commerce and encourage domestic holdings and use of foreign currencies. This chapter covers the above possibilities and their likely effect on monetary policy. Discussions in this chapter are organized depending on the motivations for holding foreign currencies (as a medium of exchange or as a means of storing value).

A. Possibilities of Promotion of Cross-Border Electronic Commerce and Use of Foreign Currencies by Electronic Payment Technology

1. Use of foreign currencies for transactional purposes

The development of electronic payment technologies that enable credit card numbers to be transmitted securely from Internet web sites has reduced the transaction costs

56. Historically, there are records that the relatively small-denomination (US$50) government bonds called Liberty Bonds issued in the United States during World War I circulated as currency (see Wallace [1983]). Also see Makinen and Woodward (1986) for a view opposite to Wallace's.

for electronic commerce and is therefore expected to encourage the spread of electronic commerce. In addition, electronic commerce is not, by nature, subject to spatial constraints and therefore is unlikely to be limited exclusively to domestic transactions. Thus, cross-border electronic commerce can be expected to grow. As discussed in Section II.C, transactions in digital goods, in particular, do not require the shipment of the product by sea or air, so the incentives for cross-border electronic commerce (exports/imports) are expected to be particularly large in this area. Therefore, it is highly likely that the development of electronic payment technologies can encourage electronic commerce and that this, in conjunction with the liberalization of foreign exchange controls and other factors, can lead to greater cross-border commercial transactions.

If volumes of cross-border electronic commerce transactions continue to increase for a prolonged period of time so that the degree of dependence on foreign trade rises, the advantages in using a common currency will increase. In other words, as cross-border transactions begin to account for a larger proportion of the business of a company, it will be more exposed to foreign exchange risks when converting between foreign currencies and its domestic currency, and therefore have an incentive to reduce those risks by retaining the foreign currency it receives and using it for payments without converting back to its domestic currency. In point of fact, since Japan liberalized its foreign exchange controls, there have been cases of transactions even between domestic companies being settled in surplus foreign currencies from export/import operations as a means of reducing foreign exchange risks.

One of the points made at the forum was that if the spread of cross-border electronic commerce integrates markets (goods, markets, financial markets, labor markets,[57] and so on) among countries with strong trading relationships, then it may not always be desirable to employ floating exchange rates based on individual currencies. There will be greater advantages to using a common currency for payments. In other words, there may be changes in the optimum currency area.

From a historical perspective, foreign currencies have only been used for domestic payments in cases in which there is a loss of confidence in the domestic currency—for example, because of hyperinflation. Some members of the forum were therefore of the opinion that the development of electronic payment technologies would have little real effect in encouraging foreign currency payments. Forum members also differed on what kinds of currencies would be used in cyberspace, and on whether there might be different optimal currencies for digital goods just as there are for ordinary goods, although the geographical conditions in optimal currency area theory would not apply in this case.

2. Use of foreign currencies as a means of store of value

There are few financial institutions in Japan (particularly in local regions) that provide foreign currency financial assets and, compared to domestic currency assets, those assets lack variety. But the development of electronic payment technologies might enable widespread use of Internet banking, which will increase the opportunities to access

57. Even in the labor market, which is generally thought to have low mobility, intellectual work can cross borders—for example, reports transmitted over the Internet, or teleconferencing.

foreign-currency denominated financial assets (including those provided by foreign financial institutions) and reduce transaction costs, which might encourage the Japanese public to hold more foreign-currency denominated assets. Obviously, however, the spread and development of electronic means of payment and electronic commerce will be only one factor in this. Some European countries have more than 5 percent of broadly defined liquidity in foreign-currency denominated deposits. The main factor in this was the liberalization of capital movements within the region.

B. The Impact on Monetary Policy Administration of Greater Use of Foreign Currencies

In this section, we assume that, in part because of the impact of electronic payment technologies, there is greater use of foreign currencies, and we discuss the influence that this would have on monetary policy.[58]

1. Use of foreign currencies as a medium of exchange

Widespread use of foreign currencies for domestic transactions would not change the central bank's ability to control short-term interest rates in the domestic currency, which is the operational target of monetary policy. This is because the control of domestic-currency short-term interest rates depends on the control of the supply of base money in the domestic currency. However, if a portion of domestic economic activities were settled in foreign currencies, domestic-currency short-term interest rates would have relatively less impact on the real economy.

An increase in foreign currency payments would probably be accompanied by an increase in foreign-currency bank lending, but monetary policy cannot influence bank lending in foreign currency. Therefore, it can be pointed out that the transmission mechanism of monetary policy through the credit channel would have become relatively weak.

In addition, when foreign currencies are widely used as a medium of exchange, a central bank may lose its autonomy in conducting monetary policy because it would have to follow the monetary policy of the country issuing the foreign currency used domestically.

2. Use of foreign currencies as a means of store of value

When foreign currencies are widely used as a means of storing value, then, as described above, the central bank will not lose its ability to influence domestic short-term interest rates. However, the wide use of foreign currencies might strengthen the arbitrage between domestic and foreign long-term real interest rates.[59] It is therefore possible that domestic short-term interest rates would have less influence over long-term real interest rates. This is not a change specific to the spread of electronic means of payment. It is merely an extension of trends seen in the process of globalization of financial markets.

58. This section covers the impact on monetary policy in a situation when foreign currency has achieved widespread use, not the process in which its use spreads.
59. This would increase the substitutability of domestic and foreign profit-making assets, and reduce the risk premium demanded for uncovered foreign currency assets.

Greater use of foreign currencies as a store of value will also mean that capital markets are more open and global. It is pointed out that central banks will be increasingly unable to simultaneously pursue both domestic targets, such as domestic prices, and fixed foreign exchange rates in their monetary policy.[60]

V. Future Tasks

The discussions at the forum focused on the development of electronic payment technology and its effect on monetary policy. The preliminary conclusion of the forum is as follows. **For the foreseeable future, electronic payment technology will not raise new issues for monetary policy that are very different from those raised by previous financial innovations, but in the long run they might substantially change financial and economic structures**. In other words, from a longer-term perspective, technological innovations such as electronic payment technology may not only lower transaction costs or make payments more efficient, but also significantly impact the organization of the financial industry, payment systems, and the real economy. We would like to conclude this report by outlining some of the issues that the forum will need to consider further in the future.

The first task is to consider the various changes that will occur in the transmission mechanism of monetary policy as a whole, due to electronic payment and other technological advances. For example, this report focuses on a theoretical analysis of the impact of the development of electronic payment technology on the money supply, but in order to associate this analysis with actual monetary policy implementation, the forum will need more comprehensive analyses that include some solution of the statistical problems. In other words, the forum will need to research further how to change the statistics of monetary aggregates in the process of the spread of the electronic payment technology, so that monetary aggregates could retain their reliability as statistics and their effectiveness as information variables. Obviously, technological advances influence more than just the money supply. As already noted, the development of electronic payment technology should be regarded as a part of the broader spectrum of technical change. For example, technological advances will have an effect on price level, which is the goal of monetary policy. The forum will need to comprehensively consider ways of enhancing useful statistics, needless to say including monetary aggregates and price indices, and creating an environment that enables a central bank to use financial market information efficiently.

The second important task is to consider what kinds of structural changes will be seen in the organization of the banking industry and in payment systems as a result of the development of technological innovations. Monetary policy (its effectiveness and the transmission mechanism) is supposed to be highly dependent on the current organization of the banking industry and payment systems. Therefore, it is highly probable that any changes in the banking industry's organization and payment

60. See Okina, K., M. Shirakawa, and S. Shiratsuka, "Financial Market Globalization: Present and Future," *Monetary and Economic Studies*, 17 (3), Institute for Monetary and Economic Studies, Bank of Japan, 1999.

systems caused by technological advances could significantly influence monetary policy implementation. For example, if, as is predicted, technological advances result in the emergence of a large number of new financial institutions providing services that are highly substitutable for those provided by traditional banks, then this will change the role of traditional banks in the effectiveness and transmission mechanism of monetary policy. It is especially intriguing to consider how central banks will need to respond to traditional banking collapses.

The third issue left to be tackled is the potential for electronic payment and other technological advances to undermine the "borders" between currency areas. As the media of communication and memory switch from paper to electrons, it is possible that physical national borders will lose their significance in financial markets and real economies. Assuming that the current central banking system is based on the local framework—that is, the nation—the trend of globalization caused by technological advances is an important issue that the forum will need to continue to study.

This forum has attempted to regard electronic payment technology as one segment of the broader spectrum of technological advance. The forum will continue to research further the effect of the technological advances on monetary policy.

APPENDIX: THE DEVELOPMENT OF ELECTRONIC PAYMENT TECHNOLOGY AND THE MONEY MULTIPLIER

In this appendix, we analyze the effect of electronic payment technologies on the money multiplier. (The descriptions below are based on the paper by Ikeo, K., T. Kawamoto, and F. Taniguchi for the fourth meeting.) We will begin by notating the relationships between high-powered money supplied by the central bank, bank reserves, and the money supply.

Money supply M is the sum of the cash balance C and the bank deposit balance D as follows.

$$M = C + D. \tag{1}$$

High-powered money H is the sum of the reserve balance R and the cash balance C as follows.

$$H = R + C. \tag{2}$$

Therefore, the money multiplier (M/H) is

$$\frac{M}{H} = \frac{C+D}{R+C} = \frac{\frac{C}{D}+1}{\frac{R}{D}+\frac{C}{D}}. \tag{3}$$

Note that C/D is the ratio of cash to deposits and that R/D is the required reserve ratio.

When electronic money appears, the definition of the money supply will be changed, adding the electronic money balance E so that[61]

$$M = C' + E + D'. \tag{4}$$

Note that C' and D' represent respectively the cash balance and deposit balance after the appearance of electronic money. The money multiplier is therefore

$$\frac{M}{H} = \frac{C' + E + D'}{R' + C'} = \frac{\frac{C'}{D'}+\frac{E}{D'}+1}{\frac{R'}{D'}+\frac{C'}{D'}}. \tag{5}$$

Comparing equations (3) and (5), it is likely that the reserve ratio R'/D' will be equal to the reserve ratio R/D prior to the appearance of electronic money. In addition, we can derive following conclusions.

61. This assumes that electronic money is held as a "stock" (in other words, that electronic money is used to some extent as a means of storing value), and that electronic money issuers also extend credit. If electronic money is only used as a means of payment and the amount of electronic money held in stock is small, the change in the money multiplier caused by the emergence of electronic money will be negligible.

(1) If electronic money is substituted for cash, then the ratio of cash to deposits C'/D' will be lower than the previous C/D. In this case, the value of $(C' + E)/D'$ will be virtually equal to the value of the previous C/D. This indicates that the money multiplier after the emergence of electronic money will become higher than previously.

(2) If electronic money is substituted for deposits, then electronic money issuers will be able to save on required reserves compared to traditional banks, so the total reserves R' will probably decline. There will be no change in $C'(C = C')$, and $E + D'$ will be virtually equal to the previous D. It is therefore easy to confirm that the money multiplier will rise in this case as well.

ATTACHMENT 1: MEMBERS OF THE FORUM ON THE DEVELOPMENT OF ELECTRONIC PAYMENT TECHNOLOGY AND ITS IMPLICATIONS ON MONETARY POLICY (AS AT MARCH 1999)

Chairman	Ryuichiro Tachi	Professor Emeritus, University of Tokyo
Members	Kazumi Asako	Professor, Hitotsubashi University, Economic Research Institute
	Fumio Hayashi	Professor, University of Tokyo, Department of Economics
	Kazuhito Ikeo	Professor, Keio University, Department of Economics
	Takatoshi Ito	Professor, Hitotsubashi University, Economic Research Institute
	Motoshige Itoh	Professor, University of Tokyo, Department of Economics
	Mitsuru Iwamura	Professor, Waseda University, Asia Pacific Research Center
	Hideki Kanda	Professor, University of Tokyo, Department of Law
	Masahiro Kawai	Professor, University of Tokyo, Social Science Research Institute
	Yutaka Kosai	Chairman, Japan Economic Research Center
	Megumi Suto	Professor, Chuo University, Economics Department
	Hiroshi Yoshikawa	Professor, University of Tokyo, Department of Economics
Observers	Toshiharu Kusu	Chief Manager, Markets Division, Monetary Planning Department, Ministry of Finance
	Naoyuki Aoki	Planning Officer, General Planning Department, Economic Planning Agency
	Kazuo Ueda	Policy Board Member, Bank of Japan
Bank of Japan	Yasushi Yamaguchi	Deputy Governor
	Kunio Okina	Director, Institute for Monetary and Economic Studies
	Mahito Uchida	Chief Manager, Research Division 1, Institute for Monetary and Economic Studies
	Wataru Takahashi	Chief Manager, Research Division 2, Institute for Monetary and Economic Studies
	Takamasa Hisada	Chief Manager, Policy Research Division, Policy Planning Office
	Shuhei Aoki	Chief Manager, Payment System Division, Financial and Payment System Office
	Fumikazu Taniguchi	Research Divisions 1 and 2, Institute for Monetary and Economic Studies
	Takuji Kawamoto	Research Division 1, Institute for Monetary and Economic Studies

ATTACHMENT 2: TOPICS OF THE FORUM ON THE DEVELOPMENT OF ELECTRONIC PAYMENT TECHNOLOGY AND ITS IMPLICATIONS ON MONETARY POLICY[62]

Meeting No. 1
Introduction of the BIS report "Implication for Central Banks of the Development of Electronic Money " (Secretariat)

Meeting No. 2
Outline of electronic money, electronic payment technologies, and their economic and social impacts (M. Iwamura)

Meeting No. 3
Dollarization and monetary policy: implications for electronic payment technologies (Secretariat)

Meeting No. 4
Points of discussion concerning electronic money (K. Ikeo)

Meeting No. 5
Electronic money and credit creation (Secretariat, on behalf of H. Yoshikawa)

Meeting No. 6
Credit cards and electronic money (T. Ito)

Meeting No. 7
Outline of report of the Study Group on an Environment for Electronic Money and Electronic Payments (H. Kanda)
MMFs and electronic money (M. Itoh)

Meeting No. 8
Discussion points not yet addressed by the forum (Secretariat)

62. Presenters' names are in parentheses.