BOJ Reports & Research Papers

October 2008

Recent Developments in Electronic Money in Japan

Payment and Settlement Systems Department

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Abstract

During fiscal 2007, the use of chip-based electronic money services marked a significant increase in Japan. The total number of cards issued by six major electronic money service providers at the end of March 2008 recorded more than 80 million, and the total value outstanding reached JPY 77.1 billion. The value and volume of transactions settled using cards reached JPY 563.6 billion and 810 million, respectively, with each total posting significant growth. This trend of increasing use of electronic money as a payment instrument can be attributed to developments such as the recent entry of new providers of electronic money services, the start of interoperability service, and the increase in the number of common terminals.

The value of electronic money issued and used remains rather small compared with more traditional retail payment instruments such as cash and credit cards. But it can also be said that electronic money is gradually strengthening its position with the potential of further growth in the future. It is worthwhile to observe how electronic money will evolve in the future in a competitive environment in terms of safety, efficiency, and convenience.

I. Introduction

The use of electronic money has been expanding quite rapidly in Japan, and its development is a prominent trend in the area of retail payments. In particular, during 2007 several major retailers and other companies launched new electronic money services, and this contributed significantly to the increase in the total number of cards issued and the total value of transactions settled using electronic money. The year 2007, therefore, is often referred to as the "year of the tipping point" in the field of electronic money.

Electronic money is expected to continue to evolve as a retail payment option, in response to consumers' changing needs and with further advancement in safety and efficiency. With this in view, the Bank of Japan has been devoting much effort to understand the overall trend in electronic money businesses, with support from major electronic money service providers. This paper provides an overview of the recent developments.

II. Trends in the Use of Electronic Money

A. Electronic Retail Payment Instruments and Electronic Money

Chart 1 shows examples of new retail payment services available in Japan. In general, "electronic money" refers to a stored-value or prepaid electronic payment instrument for multipurpose use, which requires users to "load" a certain value before using it. Electronic money can be further categorized into two types. One is a chip-based type, in which the value is recorded on the integrated circuit (IC) chip embedded in devices such as plastic cards and mobile phones.[1] In this type, the loaded value is managed on a self-contained operating system and application software. The other is a server-based type. This type does not require any physical device, and typically the value is recorded and managed centrally on the computer server of an electronic money service provider.

Credit cards, on the other hand, are post-pay instruments, in which the value is deducted from the registered user account on a designated day after the purchase is made. In the past few years, a new type of credit card service using contactless chip cards has also become available. These services do not require authorization by signature or personal

identification number (PIN), and hence enable users to make payments quickly. Since they are used in a way similar to prepaid electronic money, contactless credit cards are sometimes referred to as "post-pay electronic money."

Chart 1 Electronic Retail Payment Instruments in Japan

	Electronic money			Credit cards			Debit cards
	Server-based	Chip-based					
Access media/methods	ID and/or password	Cards (contactless)	Mobile phones	Cards (contactless)		Cards (contact)	Cards (contact)
				Mobile phones			
Examples of services in Japan	Chocom WebMoney BitCash NETCASH	Edy Suica ICOCA nanaco WAON PASMO	Edy Suica nanaco WAON	QUICPay Visa Touch iD	QUICPay Visa Touch Smartplus PayPass iD PITAPA	Relevant credit cards	J-Debit Visa-Debit
Payment timing	Prepaid			Post-pay			Real time

The number of users of both of these instruments has expanded significantly in the past few years. In particular, growth in the use of chip-based electronic money is prominent, with increasing use at point-of-sale locations such as convenience stores, electronic retail stores, restaurants, kiosks, and supermarkets.[2] Unless otherwise noted, the rest of this paper focuses on chip-based electronic money.

B. Figures on Selected Electronic Money Services

The Bank of Japan has been collecting data regarding the issuance and the use of electronic money from electronic money service providers starting from September 2007. In particular, the Bank focused on six major brands that have multipurpose use and are widely accepted throughout Japan, namely, Edy, Suica, ICOCA, PASMO, nanaco, and WAON (Chart 2).[3] The figures provided below are aggregated data of the six brands. Transaction value and volume reported by transportation companies (Suica, ICOCA, and PASMO) do not include those for fare collections (i.e., only the value and volume used for shopping are included in the data). However, the amount of value outstanding in Chart 5 includes value that can potentially be used to pay for transportation fares.

Chart 2　Launch of Electronic Money Services

Nov. 2001	Edy
Mar. 2004	Suica (fare cards from Sep. 2001)
Oct. 2005	ICOCA (fare cards from Nov. 2003)
Mar. 2007	PASMO
Apr. 2007	nanaco
Apr. 2007	WAON

1. Number of cards and terminals

At the end of March 2008, the number of cards with electronic money functionality had reached 80.61 million, and the number continues to increase (Chart 3). On average, two out of three people in Japan hold cards with electronic money functionality. The percentage of active[4] electronic money cards, however, may not be so high. In Japan, many credit cards and reward cards with electronic money functionality have been issued, but in many cases holders of these cards tend not to make use of it. Nevertheless, it can be assumed that the number of potential users of electronic money is growing as the number of cardholders increases.

Chart 3　Number of Electronic Money Cards and Terminals

	Number of cards issued		Number of terminals
	(millions)	Of which: mobile phones	(thousands)
Sep. 2007	66.49	7.67	247
Oct.	68.97	7.93	277
Nov.	71.20	8.15	281
Dec.	73.26	8.47	287
Jan. 2008	75.48	8.83	291
Feb.	78.00	9.03	295
Mar.	80.61	9.42	358
Apr.	83.63	9.69	364
May	85.74	9.90	367
Jun.	87.61	10.11	371

Note: End of each month.

The total number of cards with electronic money functionality includes the number of mobile phones with electronic money functionality. At the end of March 2008, the number of such mobile phones had reached 9.42 million, which accounts for 11.7 percent of

the total number of devices with electronic money functionality. The increase in the number of these mobile phones is also a factor contributing to the diffusion of electronic money.[5]

The venues for making payments with electronic money are also expanding. The number of terminals installed at retail stores and other locations exceeded 360 thousand at the end of March 2008 and the number is still increasing. In addition to the point of sale, electronic money is accepted at a growing number of Internet web sites, including those accessible through mobile phones.

2. Value and volume of transactions

The monthly total value and volume of transactions settled using electronic money showed its first remarkable increase during spring 2007, when new electronic money services were launched by several service providers. The increase slowed down during and after the summer of the same year, but accelerated again after March 2008. As shown in Chart 4, the total value and volume settled during fiscal 2007 (April 2007-March 2008) recorded JPY 563.6 billion and 810 million, respectively. The average value per transaction, dividing the total value by the total volume, was JPY 696.

In general, the average value per transaction is rather small for electronic money services provided by transportation companies, since the cardholders usually use the services to buy only one item at kiosks or vending machines at stations. On the other hand, the value per transaction of electronic money services provided by retail companies is relatively large, since the cardholders tend to buy several items at given stores.

During March 2008, the average volume and value per card was "once" per month, and about JPY 722, respectively. This is calculated by dividing the total volume and value of transactions settled using electronic money by the total number of cards with electronic money functionality. It should be noted, however, that the figures would be several times higher if only active cards are taken into account.

Chart 4　Value and Volume of Transactions Settled Using Electronic Money

	Volume of transactions (millions)	Value of transactions (JPY billions)	Value per transaction (JPY)
Fiscal 2007	810	563.6	696
Apr.-Jun. 2007	140	93.1	666
Jul.-Sep.	218	148.4	680
Oct.-Dec.	225	161.2	716
Jan.-Mar. 2008	226	160.9	710
Apr.-Jun.	256(+83%)	89.7(+100%)	741
Apr. 2007	31	19.3	621
May	42	29.1	692
Jun.	67	44.7	671
Jul.	72	50.6	699
Aug.	74	49.5	670
Sep.	72	48.3	671
Oct.	76	50.2	657
Nov.	73	51.1	698
Dec.	75	59.9	794
Jan. 2008	72	51.1	711
Feb.	74	51.6	700
Mar.	81	58.2	720
Apr.	83(+170%)	597(+210%)	716
May	86(+100%)	643(+120%)	752
Jun.	87(+ 31%)	657(+ 47%)	753

Notes: 1. Total for the period.

2. The figures in parentheses are year-to-year comparisons.

3. Electronic money value outstanding

At the end of March 2008, the value of electronic money outstanding was JPY 77.1 billion (Chart 5). The average value outstanding per card was JPY 957. The average value outstanding per card would be several times higher if only active cards were taken into account. It has been noted that users tend to hold relatively small amounts in the cards[6] by loading only the needed value immediately before its use.[7]

Chart 5　Value of Electronic Money Outstanding

	Amount outstanding (JPY billions)
End-Sep. 2007	64.3
End-Mar. 2008	77.1

III. Comparison with Other Retail Payment Instruments

A. Value Outstanding

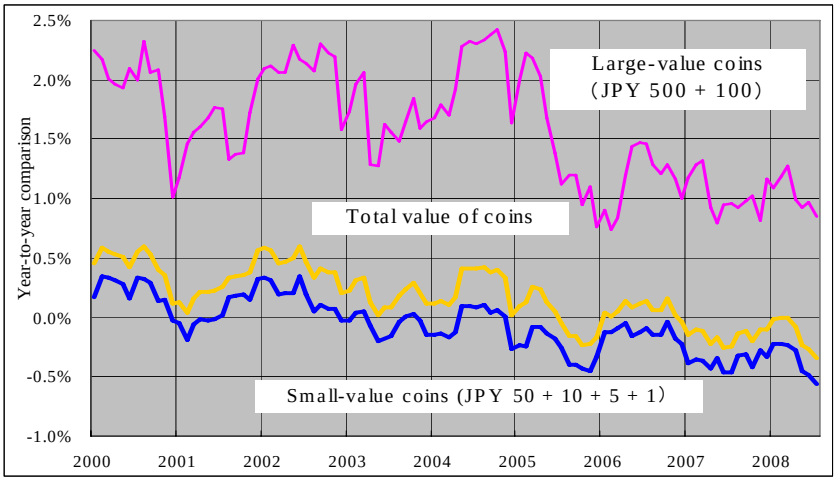
Chart 6 compares the value of electronic money outstanding with the value of cash in circulation. At the end of March 2008, the value of electronic money outstanding was 1.70 percent of the total value of coins in circulation, 0.10 percent of the total value of banknotes in circulation, and 0.10 percent of the total value of cash (coins and banknotes) in circulation. This was also about 0.007 percent of the total value of money stock outstanding (M3), which includes deposit money at private banks.

Chart 6 Percentage of Electronic Money Compared with the Value of Cash in Circulation and Money Stock

		End-Sep. 2007	End-Mar. 2008
Total cash in circulation		0.08%	0.10%
	Value of banknotes	0.08%	0.10%
	Value of coins	1.43%	1.70%
Money stock (M3)		0.006%	0.007%

These figures show that at this point, the value of electronic money outstanding is still fairly small compared with the amount of cash in circulation or the amount of money stock. At the same time, the recent increase in the use of electronic money might be having some impact on the demand for coins. This can be inferred from the fact that (1) electronic money is mainly used for small-value payments of several hundred to thousand JPY, and (2) the increase in the total value of coins in circulation, especially smaller-value coins, has been slowing down (Chart 7).

Chart 7 Volume of Coins in Circulation



B. Value and Volume of Transactions

When comparing the data for electronic money with those of credit cards and debit cards, the following observations can be made: (1) the value per transaction for electronic money is very small; and (2) the total volume of electronic money transactions has surpassed that of debit cards, although it cannot compete with that of credit cards (Chart 8).

During fiscal 2007, the average amount per transaction settled using electronic money, as mentioned previously, was JPY 696, and this is equivalent to one-hundredth of that of debit cards (JPY 66,000). In Japan, debit cards are usually used for relatively large-value purchases, for example, at electronic retail stores. The average amount per transaction settled using credit cards during fiscal 2005 was JPY 12,000, also much larger than that of electronic money. Credit cards have traditionally been used for items over JPY 10,000, partly because users of credit cards pay the actual amount of the bought items at a later time (post-pay). On the other hand, credit cards are gradually starting to be used for smaller-value payments with the recent introduction of contactless credit cards and the promotion by major supermarkets and other merchants of the use of credit cards for smaller-value payments.

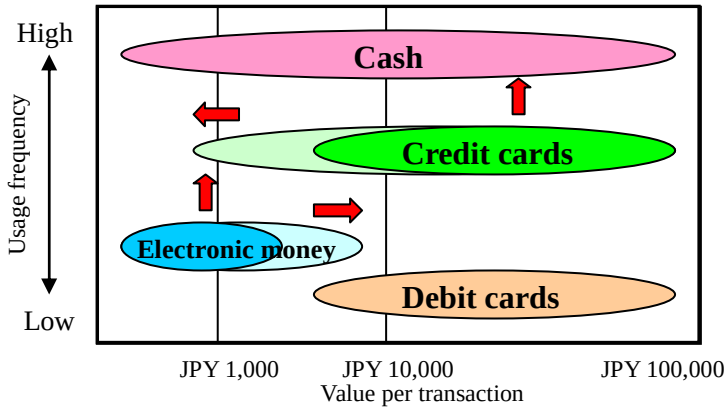
Although a significant increase can be observed, the volume of transactions settled using electronic money (810 million in fiscal 2007) still remains one-third of those settled using credit cards (2,792 million in fiscal 2005). When compared with debit cards (11.7 million in fiscal 2007), the total volume of payments made using electronic money exceeded that of debit cards by nearly 70 times. Chart 9 is a stylized illustration of the use of retail payment instruments in Japan, based on the usage frequency and value per transaction. Cash seems to be the most frequently used payment instrument in all price ranges.

Chart 8　Use of Retail Payment Instruments

	Electronic money	Debit cards (J-Debit)	Credit cards	Cash withdrawal from ATMs
Number of cards issued (millions)	80.6	410	290	N.A.
Total volume of transactions settled (millions)	810	11.7	2,792	430
Total value of transactions settled (JPY 10 billion)	56.3	76.3	3,217	2,403
Value per transaction (JPY)	696	66,000	12,000	56,000
Number of terminals (10 thousand)	36	30	136	14
Data	Fiscal 2007	Fiscal 2007	Fiscal 2005	Fiscal 2005

Sources: Japan Debit Card Promotion Association; BIS, "Statistics on Payment and Settlement Systems in Selected Countries."

Chart 9　Use of Retail Payment Instruments in Japan: A Stylized Illustration



IV. Developments in Electronic Money Services

A. New Electronic Money Services

As mentioned earlier, a number of new electronic money services were launched by major retailer groups in spring 2007. Retailer companies seem to view the issuance of electronic money more as one of the tools available to improve their main businesses. For example, while promoting the use of electronic money as a payment instrument at convenience stores and supermarkets, the retailer companies can use the information associated with the purchase for customer analysis and development of sales promotion strategies. Such a business model is quite different from those of electronic money service companies, which aim to profit from the issuance of the electronic money itself. It is expected that the future will see active competition among the different business models (see Box).

Box Electronic Money Business Models

There are a variety of business models for providing electronic money services, depending on the purpose. The following is a simple categorization of the models. It is expected that each electronic money service provider will further upgrade its business model to expand the usage of its services in an environment of increasing competition.

1. Electronic Money Service Companies

Some companies provide electronic money services as their principal business. They profit from transaction fees charged to merchants and revenues from investment of prepaid funds.

2. Transportation Companies

Transportation companies usually begin by issuing a chip-based fare card and extend the service to allow purchase of goods. Electronic money services can be started at a relatively low cost, since they can utilize existing system infrastructure.

3. Retailer Companies

Retailers such as convenience stores or supermarkets promote the holding by customers of cards with electronic money functionality to provide greater incentives for customers to spend money at the stores, thereby boosting overall sales. Service providers can also conduct purchase analysis at the individual level by utilizing information on customers' purchase behavior.

B. Enhanced Interoperability

In 2007, interoperability was enhanced among the new and existing electronic money services provided by transportation companies. In most cases, electronic money services provided by transportation companies comply with the industry standard for chip-based fare collection,[8] which makes the cards easily interoperable. Interoperability among such services is expected to be further enhanced in various regions throughout Japan.

C. Common Terminals

Since technical standards usually vary among various types of electronic money services,[9] retail stores need to install a new terminal each time they accept a new electronic money service. This is a great burden to retail stores, since the terminals occupy a lot of space around the register. To solve this inefficiency, the industry has been working to install common terminals that can accept more than one brand of electronic money. In October 2006, several electronic money service providers formed an organization for the development and operation of a common infrastructure, and started a service. The common infrastructure (i.e., a reader/writer and a central information center) can accept both chip-based electronic money and credit cards, and the number of services using a common infrastructure is increasing steadily.

V. Security and Operational Reliability

A. Fraudulent Acts

As the use of electronic money gains in popularity, a number of fraud cases have been reported. One type of reported fraudulent act related to chip-based electronic money involved the use of stolen credit card information to load electronic money value. In this case, the problem was not the breach of technical security features of the electronic money service itself, but an insufficient user authentication process carried out at the time of registration of credit card information. Nonetheless, this could have a negative impact on the confidence in electronic money services, and therefore electronic money service providers will have to take necessary measures to ensure the reliability of the overall service including the authentication process.

For chip-based electronic money, no cases of fraud attributed to insufficient security features have been reported at this point. It is generally believed that a reasonable level of security has been maintained, relative to the current level of the maximum limit on the value held on a card. Nevertheless, further improvements in the security level of chip-based devices are also necessary, taking into consideration the potential evolution of new techniques to commit fraud, and the potential increase in incentives for counterfeiting when a service provider raises the maximum value limits.

For server-based electronic money, one fraud case involved the alteration of an electronic message on the value of a credit transfer when loading electronic money value online (i.e., the value credited to the service provider's bank account was fraudulently changed to a smaller amounts than the value of electronic money loaded). Another case involved the unauthorized use of an electronic money ID, which was directly attributable to insufficient information security at the server that stores the electronic money data. In general, payment services using server-based electronic money involve a higher risk of fraud such as unauthorized use of the service including "spoofing" or hacking, since the service is provided remotely, primarily via the Internet. From this point, in order to increase the value per transaction and to expand the usage of server-based electronic money to a wider range of services, service providers are expected to make enhancements to the current user authentication process, in addition to the enhancements in security measures at the central server.[10]

B. Service Incidents

As electronic money becomes widely popular and gains position as an important payment instrument, service providers will be expected to maintain a higher level of operational reliability.

One case of service incident relating to chip-based electronic money involved a two-hour service suspension, during which payment and loading via the Internet and mobile phones were unavailable. Another incident involved a software failure at an automatic ticket gate that disabled chip-based fare collections for a certain period of time.

Chip-based electronic money services tend to be less affected by problems at the central information system, since payment processing takes place basically at the local level between merchant terminals and the card, and does not require communication with the central system except for payments at cybermalls. However, there are situations that require communication between the terminal and the central system, such as default settings at the start of the day (e.g., downloading cryptography keys and negative lists) and reporting of payment log information during or at the end of the day. Service providers need to take necessary measures to ensure the availability of their services by understanding how an incident at the central system could have an impact on the chip-based electronic money services depending on the timing of the occurrence of the incident.

VI. Conclusion

The value of electronic money outstanding still remains small compared with cash and money stock, although the use of electronic money has been gaining popularity in Japan. It can be assumed that, at this point, electronic money would not have a large impact on the overall payment system or the financial system. Nevertheless, it has great potential to become one of the popular payment instruments for small-value payments.

In May 2008, the Financial Services Agency established a working group on payment services. The group is now discussing how a regulatory framework should be reestablished in response to the emergence and spread of new types of payment services including electronic money.

It is very important to observe the trends in the use of electronic money, and how electronic money will evolve over time given the enhanced regulatory framework and active competition among electronic money service providers, giving consideration to aspects including the advancement of safety, efficiency, and convenience. The Bank of Japan will thus continue to monitor and analyze developments in electronic money services.

[1] To verify the amount recorded on the chips and to ensure information security, most of the major chip-based electronic money service providers store a copy of card balances and other data on the central system.

[2] Recently, the use of server-based electronic money is also increasing, typically for payments for online purchase of goods, digital contents, and games. For some businesses, the annual total settlement value exceeds JPY 30 billion.

[3] The monthly figures for WAON are for a one-month period ending on the 20th of each month. The figures for other brands are for each calendar month. For interoperable cards (Suica, PASMO, and ICOCA), each service provider reported the data collected from its merchants. The number of returned cards is excluded from the total number of PASMO cards starting from March 2008.

[4] "Active" means that the cards are frequently used.

[5] At the end of March 2008, the aggregated estimated number of chips with FeliCa technology, which are used for major electronic money services, had reached 200 million. Of these, more than 40 million were embedded in mobile phones (mobile FeliCa).

[6] Recorded value on the electronic money card is usually not guaranteed for the loss. This may give users more incentives to hold only a small value on the cards. For some electronic money services that require user registration, when the user loses the card, the user can notify the service provider to deactivate the card and have the value transferred onto a new card or a new mobile phone. However, unauthorized use of value between the time the user lost the card/mobile phone and the time the user notified the service provider is not guaranteed.

[7] Users of mobile phones with electronic money functionality can load the needed amount easily at any time using a mobile phone network.

[8] The standards are developed and promoted by a special committee (the Cybernetics Committee) within the Japan Railway Engineer's Association (JREA). The committee sets basic technological specifications for magnetic stripe and chip-based fare cards, and also station codes.

[9] Contactless technology called "FeliCa" is used in most of the electronic money cards currently in use; therefore, most of the cards are interoperable in terms of physical characteristics such as communication specification. However, the application process is not interoperable, since each card has different electronic money data formats, processes for handling invalid cards, and settlement procedures. Thus, common terminals have software that can accept various brands of electronic money.

[10] In April 2006, the Working Group on Information Technology Innovations and Financial System, which was established under the Sectional Committee on Financial System of the Financial System Council, released a paper entitled "Issues facing the Development of New Electronic Payment Services (Memorandum of Chairman)." The paper identifies certain points to which electronic payment service providers need to pay attention, in particular information security and system availability, with a view to enhancing confidence in their services through consumer protection and reliable payment processing.