

# Spreading Use of Digital Money

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## Summary

The purpose of this paper is to analyze the characteristics of and the relationships among digital money, financial institutions, and financial authorities. I show that digital money has many advantages on the one hand while posing a number of thorny problems on the other. As digital monetary transactions become ever more widespread and global, financial institutions must adapt their businesses and roles at the risk of otherwise losing key opportunities and possibly even their viability as an established market entity. Authorities also must address difficult issues of financial industry oversight in this digital age, and in doing so they should closely follow the trend and carefully analyze its effects.

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## 1. Introduction

It has been several years since the words “digital cash,” “electronic money,” “e-cash,” and other related terms were introduced to the modern lexicon. Needless to say, the progress made in communication and information technology has been very rapid, and the area of digital cash is no exception. The volume of such transactions is rising, yet there has been little analysis of this revolution, particularly in academic quarters. Investigating the influence and problems of this trend is an inevitable and important task, not only from a practical standpoint but from a theoretical one as well.

In the past, I have classified digital cash into an electronic wallet type and an online type.<sup>1</sup> I then proposed that material cost reduction and service price cutting<sup>2</sup> were the resultant factors of the demand for electronic wallet transactions and the means by which digital cash could spread, the technology of IC (integrated circuit) card reformation could develop, and price cutting on the supply side could occur. The popularization of the personal computer and the Internet has also prevailed, as well as the stabilization in demand of Internet-based commercial dealings as a key factor of development for online type at the demand side. General price decline for media equipment, typically computers, has been ongoing as well, helping to promote the online-type transaction at the supply side.

Electronic commerce in the United States more than tripled from 1997 to 1999. In Japan it increased four-fold during that period. Moreover, it seems that the spread of mobile telecommunications contributed to the development of digital cash. And in the near future, interactive television will be used to make transactions. IT (infor-

mation technology) has undergone a global revolution in many fields.

The purpose of this paper is to analyze the interrelational characteristics of digital money, financial institutions, and financial authorities. Section 2 specifies the definition of digital cash, including new payment instrument, the debit card. Section 3 enumerates the advantages and the disadvantages of digital cash. Here I will address the problematic aspects of digital cash that have been clarified through our ongoing experiments and that are observable in society at large. Section 4 considers the connection between digital cash and the financial institution. In section 5 I analyze the relationship of digital cash to monetary policy and the decision making of the policy authorities. Finally, section 6 is a brief conclusion.

## **2. What is digital cash?**

It is difficult to actually define what “digital cash” is. The classification has traditionally been either “IC card-type (wallet type)” or “network type (online type).” The IC card-type digital cash has the value in itself, while the network-type digital cash is data maintained on a personal computer or host computer. Recently, however, digital cash as a combination of both types has appeared. The distinction between the two is murkier than before.

Pertinent here are two forms of transaction: the “closed loop” and the “open loop.” In a closed loop transaction, the transfer of the monetary amount is in the form of digital cash. For instance, a purchaser applies for an issue of funds from a financial institution (typically a bank), the digital money is electronically transferred as payment for the commodity or service purchased, and the seller (vendor, etc.) settles the transaction at the value paid. This transaction is not transferable to any other users. The tools of the closed-loop transaction are the IC card and network digital cash.

Digital cash issued once is susceptible to being reused for subsequent settlements in an open loop where revolving-liquidity exists. This is a pitfall of the IC card-type closed-loop transaction that is in the mainstream now. Cash can be reused and divisible much more immediately while collection of non-cash instruments can be delayed when drawn on non-local payer institutions (Hancock and Humphrey, 1998).

Though credit cards, checks, debit cards, etc., have become remarkably widespread for making payments in electronic form, the differences between these and digital cash are important ones (BIS, 1996). Such financial tools should not be classified as digital money, and from the standpoint of monetary policy the distinction is particularly important.

What I am focusing on here is a form of digital cash that builds information into the card and the network, and transacts with it. The entity of digital cash has these facets: a) a concluded settlement; b) nonspecificity (no defined purpose); c) the transfer; d) circulation (freely usable); and e) anonymity. It is necessary to assign a concrete classification to digital cash as a legal currency from deposit currency, time deposit, certificate of deposit (CD), trust funds, etc. And it follows that the debit card, the prepaid card, the credit card, and the check as listed above do not fall under the digital cash definition in spite of being traded in electronic form.

The nonspecificity of digital cash far exceeds that of other electronic monetary instruments such as prepaid phone cards. It is inferior to traditional money and does not exist in closed-loop transactions. The circulation of digital cash also is low now, and it is doubtful whether anonymity exists in the form of currency deposits. Also, digital cash is not under the constraints of the laws governing traditional currency. However, our stated examples fit within the realm of the above-mentioned definition and thus should be classified as digital cash.

### **3. Advantages and disadvantages of digital cash**

In this section, I analyze the advantages and the disadvantages of digital cash.

#### **a) Advantages of digital cash**

It is common knowledge that both types of digital cash have the advantage of reducing the cost, the time, and the human-error risk of transactions for both the payer and the payee.

Santomero and Seater (1996) argued that the amount of pre-paid values stored on digital money products by households will be functions of the types of consumer goods that can be purchased using them, the availability of terminals that accept them, and the compatibility of competing digital money products with each other. Furthermore, Kane (1996) reasoned that time-of-day flexibility and the protection from violent crime provided by electronic banking and video shopping may be desirable services that paper money transactions simply cannot offer. And Kwast and Kennickle (1997) have illustrated that income, financial assets, age, and education all play important roles in determining household use of digital money products.

Due to the availability of the IC card, I do not need to carry much cash on our person or deal with the annoyance of loose change. The IC-type transaction has the additional merit of transaction privacy. As for the network-type transaction, not having to go to the scene of the purchase is one key advantage. And there is high security against theft or loss. Furthermore, it allows sellers to save on handling costs and increase business opportunities even if they traditionally have a small-scale clientele. And low-cost transactions are highly likely as cross-border business dealings increase.

Also stemming from this would be the proliferation of related commodities such

as computers and software, and the creation of a specific demand for such network transaction services.

## **b) Disadvantages of digital cash**

But despite the bright prospects that digital cash can offer, the digital money reveals some serious dilemmas. Here is a list of some important problems.

### *1) Who pays the cost of a digital cash system?*

The cost of creating digital cash is high (Rosenblum, 1996). Because it is expensive to invest in the advanced technology of the IC cards and equipment and to set up the required minimum infrastructure, the commitment to this mode of transaction must be authentic, official, and for the long term.

### *2) How are the users protected?*

This is a legal question as well as an economic and technological one. A standard has been emerging around the world that in online-type transactions, a debt incurred from the fraudulent use by another person of one's registered identity or account is the sole responsibility of the registered owner<sup>3</sup>. Still, the U.S. Commerce and Trade Code (Title 15, Chapter 41, Subchapter 6, Section 1693g) states that a consumer's liability for an unauthorized transfer shall not exceed a) \$50, or b) the monetary amount or value obtained in the unauthorized electronic funds transfer, whichever is less. Japan's commerce code has no equivalent safeguard at present.

### *3) Problems facing the issuing entity*

What happens when the issuing entity experiences an emergency, bankruptcy for instance? In the case of the European Central Bank (ECB), it assumes that the issuance of digital cash is the same as the acceptance of the deposit for those who issue it. Thus, the issuing organization should be limited specifically to the financial institution in order to a) defend the settlement system, b) protect the consumer, c)

properly execute monetary policy, and d) promote competition. It should be noted that there is some debate within Japan's Ministry of Finance about whether the issue of digital cash should be allowed via other entities as well as traditional financial institutions.

*4) Customer selection criteria*

Aspects of customer eligibility could become more technology based. For instance, being unable to use a personal computer could mean being denied certain services.

*5) How and where would taxes be levied and what would be an appropriate global standard?*

It is feasible that taxation on digital cash could be circumvented. And neither the World Trade Organization nor the U.S. has much will to tax network trading. Elsewhere in the world, the stance on the issue varies.

*6) What could be done to combat high crime?*

High crime such as counterfeiting will be significantly more difficult to pursue in the digital financial realm than it has been traditionally. At the consumer level as well there are a number of serious security concerns associated with IC-type financial transactions, including the ease with which an IC card can be lost or stolen, not to mention the possibility of its use in money laundering, which has been noted before. Despite the privacy advantage of using digital cash, IC-type transactions are not all that widespread (Berger et al., 1996). But there is a serious crime risk among network-type transactions because of the sheer volume of them<sup>4</sup>.

*7) The issue of user privacy*

Privacy is a difficult issue as it is inseparable from network security.

## 4. Digital cash and financial institution management

Many banks in developed countries have adopted several kinds of Internet banking services, and some financial institutions that specialize solely in Internet banking have been established. The possibility of cost reductions in customer services, severe competition, and a rapid increase in consumer use of the Internet have all contributed to the boom in Internet banking<sup>5</sup>.

The spread of digital cash is understood to have brought about an evolution in financial settlement. For one thing, no longer do I need to be physically present at a shop or a bank or even an ATM. We are free from having key activities of our daily lives dictated by the hours, the location, and the protocols of the business establishment. In this respect, the advantage of digital cash is substantial, as mentioned in the previous section. Moreover, even with the extra costs of incorporating the system into our financial institutions, economies of scale are such that a broad customer base is assured (Davidson, 1997; Redman, 1997).

Several major companies have announced an interface standard to be used for bank services that is expected to further reduce the construction cost of the digital system. Moreover, a movement to recognize such a global standard is growing in the United States. I can imagine, then, the possibility that some new types of financial settlements not dealt with by the banks will emerge with the spread of digital cash. In Japan such new transactions are being realized today. With regard to this, non-banking institutions pose a threat to banks and other traditional financial institutions. It is certain at least that the trend will push down money handling costs (Timewell, 1996), and the following may also develop as symptomatic of financial industry digitization:

- ① An overall decrease in the number of bank branches and staff.

- ② Banks with fewer of their own branches (commercial mega banks and some trust banks, etc.) have an advantage (Orr, 1997; Cline, 1998).
- ③ A reduction in service fees in the case of net settlements or immediate settlements (*The Banker*, 1997), as well as through use of one's personal computer for banking transactions.
- ④ By the acquisition of business information concerning commercial distribution, a bank has the means to create a monopoly.
- ⑤ When institutions other than banks join the settlement network, it increases the possibilities of systemic risk.
- ⑥ Likely to occur are tie-ups with credit-card companies and similar institutions having their own set infrastructures (*Business Week*, 1995).
- ⑦ Shifts in these types of risks are forecast. Rather than the traditional concerns such as interest rates, liquidity, and market fluctuations being at the center of attention (*Basle Commitment on Banking Supervision*, 1998), operation risks may become the focus. Having to lower the cost of information acquisition while globalization continues to influence worldwide business trends makes it difficult for banks to establish a central standard of technology and risk-management operations<sup>6</sup>.
- ⑧ If competition turns severe, confidence and reputation become more effective than before.

Of course, any new trend in the financial realm will have a ripple effect. There is the view that any move to ensure that banks are not deprived of their vested right to profit from certain transactions, for instance, would disturb the development of electronic banking. And paper-based transactions are still the mainstay, according to Humphrey and Pulley (1998), BIS (2000), and Weiner (2000), not only in the United States but in the other countries as well.

Recently, digital money help to buoy the current bank merger wave (Solomon, 1999). Mergers may pool risks and make it easier to launch successfully whether

simple credit card or electronic money just now beginning to capture the infancy of the less risk.

## **5. Digital cash and policy authorities**

It is easy to predict that digital cash will influence policy authorities. However, digital cash is seen as a bank-issued debt, or in other words, a deposit. It circulates under the assumption, the trust, or the guarantee that 100% of it can be converted to cash (a central bank note). The digital cash itself does not possess the finality of the settlement. I doubt that the policy authorities will be greatly influenced by it anytime soon. The mechanism of digital cash essentially is no different than a bank note<sup>7</sup>.

How the policy authorities might be influenced by the appearance of digital cash is laid out below.

### *a) Problem concerning management of the money supply*

I will discuss this problem in some detail. The debate continues about difficulties managing the money supply because settlements with deposit currency will decrease as settlements by digital cash increase (BIS, 1996). So, there are fears that the function of deposit creation will decrease. However, there would be no change in the money supply if the issued digital cash were to be converted immediately to traditional currency. Or if non-depository digital money issuers hold their digital money in their own checking account, the money supply will not be altered (Congressional Budget Office, 1996; Hancock and Humphrey, 2000). The problem might instead reside in what the monetary amount is and the length of time it is kept as digital cash. For instance, there would be no change in the multiplier if the digital money is issued against a bank deposit, but the multiplier increases if digital money is issued against a treasury bond, for example. Moreover, it's feasible for the multi-

plier to become unstable at the diffusion interval of digital cash. However, in the case where digital money is increasingly substituted for paper money, authorities would better be able to manage high-powered money. And regarding the national debt as well, it would not be particularly difficult for monetary authorities to gain better control of finances.

Then what would happen relating to deposit payment preparation? The effect of the multiplier exists as long as demand continues for the cash the central bank issues or prepares for deposit payment. However, as digital cash prevails, the comparative ratio of deposit payment preparations shrinks. Though the spread of digital cash naturally decreases the preparation requirements for payment, the multiplier rises and so does the possibility of the trend having an effect on monetary policy.

There is some possibility that a rise in the inter-bank market interest rate would be one side effect of a lack of deposit payment preparations. I can also assume that the confidence multiplier would expand to infinity, because a legal preparation framework does not currently exist. However, since a) the issuing body handles payment preparation, b) part of it is converted into cash and a deposit, and c) the lending demand is limited, the independent acceleration of such a movement may not occur.

Finally, when the digital currency of one country is converted into the digital currency of another, money-supply management becomes difficult.

*b) Problem of money demand*

The function of money is as a) a value standard, b) a payment instrument, and c) a stored value. Digital cash is viewed as chiefly functioning as a payment instrument. Tobin's "stock theory" is useful when thinking about this. The cost of going to a bank, changing a deposit into money, and the cash demand are positively correlated. If I apply this theory, then it follows that digital money decreases the cash demand. However, it is true that liquidity will rise, so digital money has the possibil-

ity of making the overall money demand unstable.

The influence of digital cash was considered from the money-supply side and from the demand side in a) and b) of this section. Then, the shift of the multiplier and the money demand that may result cannot be predicted accurately. At this time, what should policy authorities do? According to standard economics theory, if the shock of the economic fluctuation is real, stabilizing the amount of the money supply rather than the interest rate reduces the breadth of the shift in real GDP. Conversely if the shock to the money demand is large, stabilizing the interest rate rather than the money supply reduces the change in real GDP (Poole 1970, etc.). Therefore, when an unanticipated money shock occurs in the market in the guise of digital cash, I should stabilize the interest rate.

There has been much discussion about whether monetary authorities should give precedence to controlling the money supply (or the exchange rate) as an intermediate goal over attaining price stability or economic growth. A typical example in which the money supply has been targeted as the intermediate goal is Germany (Gerlach, 1999). However, if authorities adopted such an approach, their control over the money supply would disrupt the stable relationship between the money supply and inflation, and thus economic growth as well. So it appears preferable for monetary authorities to control interest rates instead of the money supply in the digital cash environment. Woodford (2000) says macroeconomic stabilization depends only upon the ability of central banks to control a short-term nominal interest rate.

*c) Problem of the expansion of foreign currency use*

If a part of domestic economic activity is based on foreign currency, its influence, which is conveyed by the domestic currency's short-term interest rate, can pull down the "real economy." Moreover, the influence of monetary policy can become insignificant, being limited to bank lending in domestic currency. And price changes for goods and services provided by foreign countries may influence the domestic

economy as well.

The impact on domestic short-term interest rates would not be weak be relatively strong as long as the policy authorities control the “high-powered” money. However, it’s possible that the effect of fluctuations in the domestic short-term interest rate on the long-term rate is weakened through arbitrage trading. And the mechanism of arbitrage trading buffers itself against much influence from the movements in short-term interest rates. However, this is not limited to the digital cash environment alone.

*d) Problem of taxation*

Tax evasion and trends toward tax cutting would lead to a decrease in revenue. The liquidity of digital money is quite high. People can transfer money easily and quickly.

*e) Restrictions and supervisory problems*

Via the Internet, money is easily transferred to a deposited in financial institutions overseas, especially into those countries having few or no regulatory controls. This risks creating the domino effect of currency contagion and corruptive influences of the recipient country over the originating country. Restriction and supervision of such transactions is virtually impossible without the countries’ mutual cooperation. Moreover, the individual scope of the financial institutions pose their own problems, since financial systems differ among countries. The problem of the scope of deposit insurance is present as well.

*f) Problem of money laundering, etc.*

Government intervention regarding code keys and other transaction aspects may arise. Wanting to adopt such measures is natural for the authorities, but a conflict with the issue of personal privacy surfaces (Mester, 2000).

Finally, the authorities lose profit, because money (not digital cash) is a debt with no interest and the authorities acquire interest from assets. Or the substitution

of privately issued digital money for government-issued currency reduces seignorage<sup>8</sup>. But the pursuit of profit is not their objective, nor is it the goal of the central bank, as the ECB says.

## 6. Conclusion

Here I have laid out the advantages and disadvantages of digital cash. It's easy to believe that there are many advantages to promoting digital cash. It also seems that the progress of IT is unstoppable, but fortunately this will make our world a more convenient and efficient place to live.

Nevertheless, there are a number of concurrent problems. I have analyzed these issues not only from the customer standpoint but also regarding financial institutions and authorities.

For financial institutions, this trend cannot be stopped, and so it would be prudent for them to view it as a business opportunity. If they do not find ways to adapt, they will become obsolete and fade away completely from the market. The authorities should pay careful heed as well, guiding the “sound” market to maturity and taking care not to confuse it with excessive intervention. At the same time, they must maintain a sound financial system.

I cannot turn back now. What I need to do is analyze this trend not just from a practical perspective but also from a theoretical one. Much research ahead is also anticipated within the academic quarter.

### Notes

1. In detail, see Kurihara (2000).
2. See, for example, U.S. Department of Commerce (1998).
3. The settlement service for which insurance is included.
4. Counterfeiting has broadened to include digital cash as well as paper money. And the liquidity,

speed and anonymity of digital money tends to be higher than that of paper money.

5. See, for example, Lubove (1996), U.S. Department of Commerce (1998). In Japan it is becoming preferable to avoid low interest rates.
6. Salomon (1996) also suggests the possibility that some computer software companies may become competing against financial institutions.
7. However, a current system is subject to radical change if it is first established outside of an existing system; for example, a second central bank.
8. Lacker (1996) has applied this result in a general equilibrium model.

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