# SOME AMBIGUITIES CONCERNING THE DEVELOPMENT OF ELECTRONIC MONEY[1]

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*Abstract*

*The aim of this paper is to analyse the economic efficiency of electronic money and to identify different factors hindering its growth. It is argued that electronic money might eventually make paper money obsolete. Nevertheless, prospects for the development of this monetary innovation remain uncertain due to the complexity and ambiguity of electronic money products. In particular, the paper identifies network effects and habit persistence as major factors hindering the adoption and more widespread use of electronic money.*

*Keywords: e-money, ICT, network externalities, habit persistence.*

> *Around the world, entrepreneurs and institutions are racing to develop effective means of exchange for transaction across the internet and World Wide Web. Their aim is to create units of purchasing power that are fully usable and transferable electronically: 'virtual' money that can be employed as easily as conventional currencies to acquire real goods and services. The era of electronic money will be soon upon us.*
>
> (Cohen. B.J, *The Future of Money,* 2004)

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## 1 Introduction

The last decade of the 20th century was a prosperous decade economically, characterised by significant advances in technological innovation and adaptation and their application in all socioeconomic activities. Some observers argue about a move toward a new economic era - a knowledge-based economy or a digital economy- which might lead to a third industrial revolution comparable to the first represented by the development of spinning machinery and the steam engine in the late 18th and the second characterised by the development of electricity and railroads in the late 19th century (Mokyr, 1999).

The last decade of the 20th century was also marked by rapidly decreasing costs and improvements in performance of computing and telecommunications. As a result, the computer is becoming omnipresent: most offices use computers for managing their internal and external activities, and more and more households are becoming connected to the Internet and other networks. This development has encouraged commercial activity over the Internet and allowed a larger variety of assets to be exchanged electronically. It has also led to the development of some new forms of assets. The new form of "money" that has received most attention around the world is called "e-money products". This term refers to pre-payment systems in the real and the virtual worlds whose purpose is to enhance the effectiveness of existent payment systems and replace cash and coins in retail transactions.

Actually, there is no universal definition of e-money. The Bank for International Settlements (BIS, 1996:1) affirms that electronic money is difficult to define because it combines specifics technological and economic characteristics. In addition, various e-money schemes are being developed and they differ considerably in their features, their technical implementation, and in the way in which value is transferred. (ibid., 2). As a result, several definitions of electronic money have evolved over time (Baddeley, 2004). In 1998, the ECB defined electronic money as "an electronic store of monetary value on a technical device that may be widely used for making payments to undertakings other than the issuer without necessarily involving bank accounts in the transaction, but acting as a prepaid bearer instrument" (ECB, 1998:7).

Despite the strong interest worldwide in e-money, the adoption of this monetary innovation is still in its primary stage. It has not been in widespread use so far either in the European Union or in other industrial countries. Cash remains the dominant means of payment especially in small-value retail payments and everyday retail transactions.

The aim of this paper is to analyse the economic aspects of e-money and to identify factors which might hinder its growth. The existing literature on the development of e-money is limited. For instance Hymphery et al. (2001) and Stavins (2001) explain the problem of e-money development from the supply side. They argue that the slow adoption of electronic payment systems such as e-money is due to high fixed costs, which require large up-front investment on the part of merchants. Some others contributors explain the problem facing e-money development from the demand side (Stavins, 1997; Bounie and Abel, 2006). They argue that the use of electronic payment systems requires many preconditions, such as a relatively high level of income and education, which are not necessary for the use of other payment instruments.

The main contribution of this paper is to argue that the adoption and use of electronic money products also depend on two other factors. The first one is network externa-

lities and the two-sided (adoption and use) nature of the market for the use of electronic money. The second one is the "the habit problem", a psychological factor related to so-called path dependency in the development and use of electronic money.

The rest of the paper is structured as follows. The first section describes the evolution of electronic forms of payment (e-money) and analyses their economic efficiency. The second section examines barriers hindering the more widespread use of electronic money, including network effects and habit persistence. The conclusion summarises the findings.

## 2 ICT revolution and money innovation

Electronic money is not a new phenomenon. Since the Information and Computing Technology (ICT) revolution in the middle of the nineties, the falling cost of computing and semiconductors and the growth of internationally interconnected computer networks, the majority of payments are becoming electronic. Commerce over the Internet is increasing the use of these new technologies and consequently, the demand for a new electronic payment system is enhanced.

However, the electronic transfer of payments in retail financial transactions and the use of the Internet as a monetary marketplace are relatively new. As a result, the geography of money has changed (Cohen, 1998). Due to the ICT revolution, a new form of electronic payments appeared and quickly received considerable attention around the world and we talk about electronic money products (also known as electronic cash, e-purse, e-currency, digital currency, digital money, scrip or digital cash). Money has information stored in a microprocessor or on a computer database which allow data, including account balances, personal information, PIN codes, shopping information and loyalty rewards to be stored on the card. The purpose is incontestably to enhance and to improve the efficiency of traditional payments systems.

### *2.1 The evolution of the electronic payment system*

Electronic payment systems have existed since the sixties of the last century with the invention of the Electronic Funds Transfer (EFT) which has grown in number and sophistication around the world (see Table 1). EFT implies the application of computer and telecommunication technology in making or processing payments. Generally this system was used by banks and other financial institutions to exchange and to transfer large amounts of money at national and international levels.

The essence of EFT is to make money move via networks as a substitute for cash or cheques to conduct transactions; the purpose is also to save time and to reduce transaction costs. The use of EFT became widespread with the introduction and acceptance of automated teller machines (*ATM*s) which enable direct fund transfers at points of sale (*EFTPOS*)**.** The EFT is considered the first step of payment *electronification***.**

In the early 1980s, thanks to the development of network technologies and the falling costs of telecom and data processing, electronic payments became even more useful with the appearance of credit and debit card payment technology. Some years after its invention, this became the most popular electronic instrument for making retail payments. The development of encryption played a major role in the success of the card-payment system. This innovation was considered the second step of payment *electronification.*

*Table 1 Evolution of the number of terminals (thousands, end of year)*

| | ATMs | | | | | POS terminals | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2001 | 2002 | 2003 | 2004 | 2005 | 2001 | 2002 | 2003 | 2004 | 2005 |
| Canada | 35.6 | 40.0 | 44.2 | 48.5 | 52.7 | 463.2 | 494.9 | 520.6 | 546.0 | 571.4 |
| France | 36.9 | 39.0 | 42.0 | 43.7 | 47.8 | 904.3 | 956.4 | 1000.0 | 1060.0 | 1095.0 |
| Germany | 49.6 | 50.5 | 51.1 | 52.6 | 53.4 | 435.7 | 460.6 | 495.8 | 520.0 | 569.5 |
| Italy | 36.6 | 39.6 | 39.1 | 39.7 | 40.6 | 774.7 | 847.5 | 928.0 | 1.007.5 | 1045.0 |
| Netherland | 7.1 | 7.5 | 7.6 | 7.9 | 7.5 | 165.8 | 177.2 | 186.3 | 195.0 | 206.4 |
| Sweden | 2.6 | 2.6 | 2.7 | 2.7 | 2.8 | 88.2 | 102.0 | 108.1 | 161.1 | 176.6 |
| Switzerland | 5.0 | 5.2 | 5.4 | 5.4 | 5.6 | 73.9 | 80.7 | 80.0 | 88.1 | 110.2 |
| UK | 36.7 | 40.8 | 46.5 | 54.4 | 58.3 | 772.0 | 810.6 | 861.3 | 920.0 | 974.1 |

*Source: BIS, 2006*

The rise and acceptance of card payment had a negative repercussion on the traditional payment system. There was a transition from paper-based instruments, in particular cheques and cash, to electronic-based instruments in many countries. For the first time ever, payments with cheques decreased as a proportion of the total transactions in a lot of countries. As Table 2 shows, cheques (as the popular instrument for payments) lost their market share and are actually declining even in absolute volume. Some countries like the Netherlands, Germany and Belgium are already moving toward the *cheque-less society*.

*Table 2 Number of cheques per year and per capita in selected countries*

| | 1990 | 2004 |
|---|---|---|
| France | 80 | 66 |
| UK | 56 | 35 |
| Belgium | 21 | 2 |
| Italy | 15 | 8 |
| Germany | 10 | 1 |
| Netherlands | 17 | 0 |
| Spain | 7 | 5 |

*Source: European Central Bank, 2005*

### *2.2 The birth of e-money*

Electronic money has a twofold origin. Firstly, according to Austrian economic analysis (Menger, 1982; Von Hayek, 1976; Centi, 1979, etc), money as a "social institution" is anyway subject to ongoing institutional change; it is interpreted as the fruit of a spontaneous evolution intended to cure the disadvantages of barter and the double coincidence of want. E-money is the most recent stage of this development and is a further instance of institutional change (Schmitz, 2001). TTS principal role is to stimulate electronic

trade over the World Wide Web, facilitate transactions, reduce their costs and finally to substitute for coins and bills in small sums, i.e., in the retail payments. The second origin of e-money is related to the ICT revolution characterized by the integration of information processing and telecommunications technologies and the increase of the geographical distance over which information can be transmitted and spread among the public and around the world. ICT has modified the financial sector and is making payment systems more reliable and effective, giving the birth to a new monetary intermediary circulating through networks.

ICT is a typical revolution but e-money is not, it is simply a new way of processing information and storing purchasing power. According to White (1996), the various financial innovations do not create new forms of money, but are rather new ways of employing existing money in transactions. Despite the consequences of the technological boom, the nature of money is still the same, with its famous three functions[2]. The nature of money will never change and it will usually be only the intermediary by which goods and services are exchanged.

The e-money[3] card is a new means of payment which makes it possible to transfer value from card to terminal or card to wallet electronically only, both in the physical world and via networks. This monetary innovation is seen as a fundamental achievement; it carries a preloaded monetary value and can be used as a means of payment for multiple small-value purchases. The purse contains a microprocessor in which information and monetary value are stored. It represents a technological advance on cards with magnetic stripes, and also includes higher level of security that can dramatically reduce fraud because chip cards are much more difficult to counterfeit than magnetic stripe cards.

*Table 3 Design features of e-money products in some countries 2004*

| Country | Name of systems | Loading procedures | Transferability among end users | Adapted for network payment | Multifunctional payment features |
|---|---|---|---|---|---|
| Belgium | Proton | ATM, phone, internet | No | No | Yes (debit card function and ATM access) |
| Czech Republic | FUNCHIP | Terminal | No | No | No |
| Denmark | Danmøn | ATM | No | No | No |
| France | Moneo | ATM | No | No | Yes (debit card function) |
| Germany | GeldKarte | ATM | No | Yes | Yes |
| Netherlands | Chipknip | Dedicated loading device | No | No | > 70% issued on debit card |
| Switzerland | CASH | ATM | No | No | Yes |

*Source: BIS (2004)*

[2] Money serves as a medium of exchange, unit of account, and store of value.

[3] E-money products need to be distinguished from the access products which generally allow consumers to use electronic means of communication to access conventional payment services.

The first e-money card, named Danmøn, was created by Danish industrial enterprises in 1992. This experience was a success and since then a lot of countries around the world have been trying out different e-money card projects. As Table 3 shows, the functions and characteristics of an e-money card vary from one country to another.

### *2.3 Why e-money?*

Cash has a lot of disadvantages. In addition cash holding costs are high and numerous – including retail transaction accounting, theft, loss of cash, safekeeping and security, deposit costs, as well as costs related to cash management services provided by financial institutions. In his criticism of cash, James Gleick argued that: "*Cash is dirty ... Cash is heavy ... Cash is inequitable ... Cash is quaint, technologically speaking ... Cash is expensive ... Cash is obsolete* (Goodhart and Krueger, 2001).

E-money aims at replacing cash for small transactions and eliminating its drawbacks. 'Moneo'[4] is the name of the French experience in the e-money card. It was created in order to reduce these costs and to provide a new way of storing and transporting purchasing power temporally. Moneo should facilitate a variety of low value retail transactions and should consequently be a substitute for real cash. It is a modern and rapid payment means; it will certainly be of great convenience for its users.

Moneo provides numerous benefits to both consumers and merchants. Benefits to consumers include convenience, speed and possible rewards, such as discounts on future purchases, obviation of the need to have the correct change for a transaction or to handle[5] a lot small coins. The incidence of error in calculating change from transactions would also be reduced. Moneo owners might be able to carry fewer bank cards, especially if credit card and debit card functions are also included in the electronic purse card; owners will feel more secure, and solve the exact change problem (Gerald, 1996). Benefits to merchants include receiving cash in advance of the delivery of goods and services, increased loyalty, potentially faster payment processing at the point of sale, and potentially lower payment processing costs. Note that if the benefit to the retailer is greater than the cost, the retailer may "pay" customers to purchase and use its prepaid card (Chakravorti and Victor, 2006)**.**

Moneo has also a great advantage compared to other POS cards: while debit or credit cards are not efficient for micro-payment because the transaction related-cost is high for both consumer and merchant, electronic money can be use at a low cost. As table 4 shows, payment with e-money is costless compared to other means of payment, notably debit and credit cards. Another argument in favour of the Moneo card is that the purse contains a new encryption technology that reinforces its security and limits fraud. In addition, payment with Moneo further reduces transaction costs since it does not require authorisation or customer identification.

[4] Moneo is available via disposable cards or reloadable chip cards issued by banks (e-money functionality built into a bank/credit card). Loading is possible via ATMs or via Internet using a PC software application and card reader.

[5] There are opportunity costs of holding cash that rise with interest rate and inflation.

*Table 4 Costs of different means of payment for holder and issuer (in $)*

| Means of payment | Cost for issuer | Cost for holder |
|---|---|---|
| Cheques | 3.00 | 6.00 |
| Credit card | 0.80 | 2.50 |
| Debit card | 0.40 | 0.60 |
| Cash | 0.15 | 0.30 |
| E-purse | 0.07 | 0.07 |

*Source: Mair,1999*

The new technologies will enable people to acquire the goods they want without holding or handling cash, which is a troublesome, non-earning asset. In the future, trade will be executed by instantaneous and simultaneous debiting and crediting of liquid-wealth accounts, held by both banking and non-banking institutions. The new electronic digital-payments technology will enable property-rights claims on real assets, such as stock and bond funds, or gold, to be utilized as the medium of exchange for virtually all transactions. (Rahn, 2000).

### *2.4 Payment with e-money and transaction costs*

Carrying out payments on the classical money market requires at least one seller and one buyer, both in contact with banks interconnected via a clearing house. The final payment using a traditional instrument, like cheques or bank transfers, requires the intervention of a third party called financial intermediaries such as banks.

Payment with e-money reproduces the traditional scheme: that means the two actors and one or two banks. However, what is relatively new is that the transaction process is becoming easier and more efficient than payment with cash or other forms of payment. A transaction does not require any personal code and it may not exceed a defined amount. If the purchasing power of the chip is totally exhausted, the purse can be reloaded automatically at the merchant without any additional fees, thanks to the special terminal POS. Once the chip is charged, the user does not incur travelling expenses to look for money or lose time in providing the right change. In addition problems of theft or loss of money are reduced to the minimum. A transaction with e-money does not immediately need any intermediary because the money is transferred electronically as units (called bits) from the payer to the payee. When the amount of the consumer transaction made with electronic purse is stored in the merchant's terminal it will then be transferred to his account at a financial institution from time to time through on-line transactions.

The particularity of payment with e-money is the fall in transaction cost and gain in time as compared to other forms of payment. Humphrey et al. (2003:172) estimate that "electronic money costs only from one-third to one-half as much as a paper-based payment. If a country moves from a wholly paper-based payment system to close to an all electronic system, it may save 1% or more of its GDP annually once the transition costs are absorbed"..

## 3 Barriers hindering the development of e-money

When the e-money product was first introduced, it was hailed as the money of the 21st century due to its particularities and its advantages for consumers, merchants and financial institutions[6]. However, statistics on the adoption of electronic payment system reveal that the e-money product is still at a primary stage. According to the Blue Book of the ECB (2005), payments with pre-paid cards represents only 0.7% of the total of the scrip means of payment used in the Euro era[7]. This new money innovation has been not in widespread use so far neither in the European Union nor in other industrial countries. Cash continues to be used as the most important single means of payment for the majority of households' retail transactions.

Beyond the two reasons quoted at the top of the paper (the supply-side and the demand-side), we argue that the use of electronic money products depends on two other factors that explain its slow adoption. The first one is network externalities and the two-sided market (adoption and use) and the second one is the psychological factor, notably the path dependency that we will call the habit problem.

### *3.1 Acceptability of e-money and networks effect*

The extent of the spread of e-money will depend on the incentives for issuers, consumers and merchants to use it (BIS, 1996:3).

• The demand by *consumers* for e-money will depend on how the schemes compare with other payment methods in terms of the fees (if any) charged by issuers, the perceived security and privacy of e-money, the ease with which the e-money devices can be used, and the willingness of merchants to accept e-money.

• Potential incentives for *issuers* include the revenues from any fees charged to consumers and merchants, revenues from the investment of the outstanding balances and, for bank issuers, cost savings from reduced cash handling (to the extent that e-money replaces cash). Acting as a possible disincentive could be the cost of meeting any existing or expected future regulation.

• *Merchants'* willingness to accept e-money will be related to the size of fees imposed by the issuers or operators, the cost of terminals and the reduction in the cost to them of handling cash. As far as both consumers and merchants are concerned, a key factor will be their willingness to adopt new technology. Most observers seem to believe that the spread of e-money products will be moderate in the short and medium term but could become more extensive in the longer run.

According to those reasons, we perceive that the use of electronic money becomes complicated and fundamentally depends on the interaction between users of the same product or service. These complementarities may be an obstacle of the start up and growth of money innovation.

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[6] Electronic means of payment are less costly to manage than cash or cheques (Hymphrey, 2001).

[7] In opposition to the fiduciary money (constituted of the bills and coins), the scriptural means of payment (card, cheque, transfer, withdrawal, etc.) are devices which allow the transfer of funds held in accounts by credit institutions or comparable institutions (fund of the deposits and consignments, Treasury...) following the handing-over of a payment order. Scrip money is settled via inter-bank payment systems.

### *3.2 The economic theory of network externalities*

According to Schmalensee (1995), a network can be defined as a set of nodes connected, directly or indirectly by a set of links. Schmalensee argue that a major feature of a network is the presence of network externalities. This concept is abundantly used in economic literature; it is also of recurring interest in industrial organization and public economics (Katz and Shapiro, 1986; Schamlensee, 1995; Economides, 1996).

The term 'network externality' refers to the phenomenon whereby a service becomes more valuable as more people use it, thereby encouraging ever-increasing numbers of adopters. (A significant part of the value of the product/network is the other participants of the network). This is also known as increasing returns to scale and a positive spiral. This effect is common in digital products, more specifically, products that benefit from the connectivity of the customer base. Telephones, fax machines and computer operating systems are examples. Its success is due to compatibility and conformity issues, not that the product or technology may be superior or inferior to the competition.

In discussing the Internet, the concept of network externalities has been popularized in a statement known as "Metcalfe's Law", which roughly claims that the value of a given network is proportional to the square of the number of its users[8].

Farrell and Saloner (1985) and Katz and Shapiro (1986) provide early analyses of network externalities; they have classified it in two groups: direct and indirect network externalities. Direct network externalities exist when an increase in the size of a network increases the number of others with whom one can "communicate" directly. In this sort of network there is a kind of interaction and there are complementarities between users of the same product or service. Indirect network externalities exist when an increase in the size of a network expands the range of complementary products available to the members of the network.

Network externalities introduce dynamic considerations for both users and producers (Klenow, 2002). For users, the adoption decision must take into account the size of the network in the future to avoid being stranded in an unpopular network. Firms have incentives to invest in building proprietary networks from which they can earn rents.

Markets that experience network effects are prone to become more effective as more people join one network (product in the market) rather than having the market segmented with many proprietary networks (competitive market). Once network effects are established, markets tend to tip, favouring the market leader at the expense of other products in the marketplace.

### *3.3 Conditions for e-money use*

E-money is a typical network good and, as such, the impact of its introduction as a means of exchange can be analyzed through the concepts of network and the theory of network externalities (Arnone and Bandiera, 2004:6).

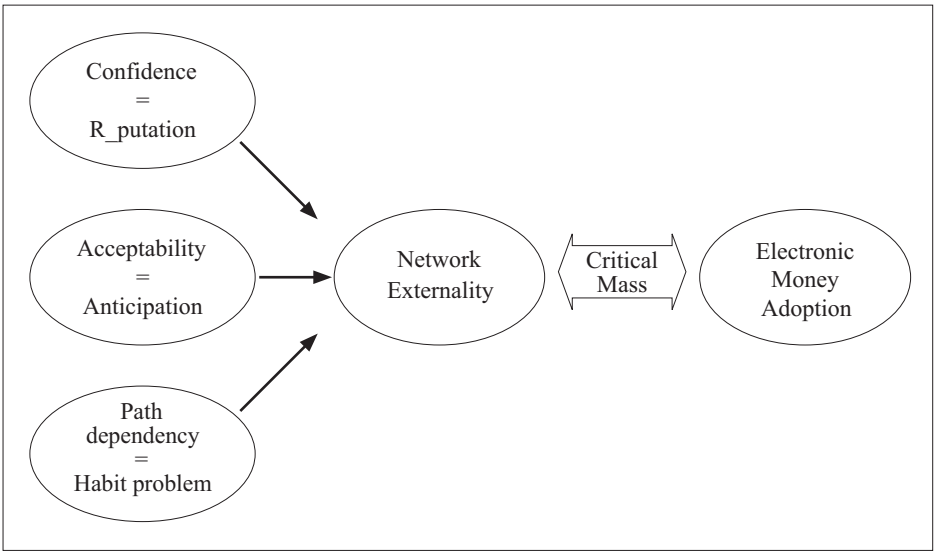
[8] "Metcalfe's Law" is named after Bob Metcalfe, the inventor of the Ethernet (Shapiro and Varian, 1999:184).

In economic theory, the utility of money increases proportionately to the number of people using it. In this sense money is like a telephone network: expanding the size of the network increases the value of using the telephone to the original subscribers. However an economic actor accepts using a new currency, such as e-money, if he has confidence in it and that this money is generally accepted by other people. The general *acceptability* of money is a fundamental criterion of its success; it explains the importance of this institution (money) in the economy. Therefore, it arises from the analysis of the determinants of money acceptance, that money may be used because an individual believes (anticipates) that others will use it.

Krueger (1999) said that as long as the value of the money is not systematically and strongly reduced, it will be accepted. What makes money acceptable to an individual is the belief or the experience that it is also accepted by others. The anticipation factor is a crucial determinant of money acceptance, we can compare this conclusion to the *bootstrap effect* highlighted by Iwai (1997) *"money is money because it is used as money"*.

Menger (1892) said "When the relatively most saleable commodities have become 'money' the event has in the first place the effect of substantially increasing their originally high saleableness. Every economic subject bringing less-saleable wares to market (...) has thenceforth a stronger interest in converting what he has in the first instance into wares which have become money" (Menger, 250).

*Fiure 1 Factors influencing e-money development*




As the Figure 1 shows, acceptability, confidence and anticipation are fundamental factors that make the expansion of the network easier. But they are not sufficient, because the network size needs also an interdependency of demand, which means that the market for a network good must reach a minimum size before a sustainable equilibrium can

be achieved. Economides and Himmelberg (1995) call this minimum size the network's "critical mass."[9]

### *3.4 Interdependency problem and critical mass paradox*

Oliver et al. (1985) defined critical mass as *a small segment of the population that chooses to make big contributions to the collective action while the majorities do little or nothing. Critical mass or the installed base* of network facilities play an essential role in the start up and development of a network.

The concept of critical mass formalizes the "chicken and the egg" paradox[10]: many consumers are not interested in purchasing the good because the installed base is too small, and the installed base is too small because an insufficiently large number of consumers have purchased the good. Thus, consumers' expectations of no provision of a network good may be fulfilled. However, for a range of costs, expectations of positive level(s) of sales of the network good are also fulfilled. Often, there are multiple fulfilled expectation equilibriums. Consumers and producers can coordinate to reach any one of them (Economides and Himmelberg, 1995:7).

Electronic money cards, like other innovations that involve the creation of networks between the producers of services and their consumers, are said to provide network externalities and need to accomplish a critical mass before the card can be used effectively; this phenomenon is called in modern literature "two sided markets". This interesting literature explains that the development of a payment instrument largely depends on two types of externalities related to adoption and use. Those conditions are essential because the average consumer's benefit from using a money innovation in transactions depends on how many other consumers and businesses are using the same medium. In addition, the total benefit associated with the use of e-money cards exceeds the benefit accruing directly to an individual consumer. By extending the network, one person's participation also increases the benefit to others. In this situation a *Catch-22* dilemma arises from the introduction of a new payments instrument. A critical mass in the electronic money card market will be achieved when the demand interdependency between payer and payee is no longer economically significant and also when the consumer's expected benefit from having an e-money card is not materially affected by the small increase in the number of consumers using it; but up to this stage (Osterberg and Thomson, 1998), there will be considerable uncertainty among both consumers and merchants as to the potential usefulness of the product. Clearly, the benefits to consumers will rise as the new means of payment becomes acceptable to merchants, while the benefits to merchants will rise with greater usage by consumers. Second, the attractiveness of electronic purses to both consumers and retailers may be hindered by the presence of competing and incompatible systems, as was the case for videocassette recorders a number of years ago.

[9] Called also *Catch-22 dilemma*, *chicken-and-egg*-problem (no supply thus no demand, or no demand thus no supply). For more detail see Osterberg and Thomson (1998) and Oliver et al. (1985).

[10] From another view point, this paradox may be also formalised as: if the merchant refuse to invest in a new system the use becomes weak, the request becomes vulnerable but also expensive for the consumer, *see* Katz and Shapiro (1986)

The externality consumption conducts to a complicated paradox which means that investors must invest colossal amounts of money in subsidising appliances and other costs of joining the network before they reach commercial practicality. Thus use and spread of electronic money as a network good is complex and ambiguous because *interdependence of demand* will remain an obstacle[11] until the innovation achieves a critical mass, either in its own time or with the authorities' help. According to Katz and Shapiro (1986) analysis, the growth of a network can be self-fulfilling in nature. In the payment area, the slow adoption of e-money schemes serves again as a good example.

### *3.5 The problem of habit persistence*

Is it easy to achieve a critical mass in the use of e-money? The answer is no because one needs a large number of participants: on the one hand, merchants must invest to be equipped with special POS terminals in order to accept payments with e-money[12]. On the other hand, consumers must use e-money in its various forms for retail transactions as a substitute for banknotes and coins. The essence of the problem is thus to convince a large number of users to adopt e-money innovations.

One reason why it is difficult for people to use a new payment instrument that has not been highlighted in the literature is the ingrained habit of using cash and cheques for retail transactions. For instance, in some countries such as France, payment with cheques has over the years become a part of the cultural heritage. As a result, changing the habit of paying with cheques is very difficult. More generally, the habit of the presence of a middleman, called banks, for each transaction may also be a reason for the slow implementation of e-money since this latter does not necessitate any intermediary. People have longed trusted these financial institutions and are not used to managing their money themselves[13]. Consequently, they are reluctant to carry out their transactions without the presence of theses intermediaries. A large number of people need an apprenticeship process in order to familiarise themselves with new payment instruments. Most people in these circumstances adopt a *wait and see* attitude towards innovations such as e-money, they want to have more confidence and trust about such innovations before starting to use them. This habit persistence is perhaps an important reason why e-money is not actually in more widespread use[14].

Habit persistence is not a new phenomenon. With many earlier significant innovations, it took many years before their economic impact and an expansion in their use could be observed. For example, only 5% of American companies and 3% of households used electric power in 1889, eight years after the first electric generator in New York was put

[11] A consumer's benefits from having a new payment instrument depends on how many businesses will take it in payment. On the other hand, merchants and service providers will refuse to invest in the systems needed to accept the new payment instrument until they are sure that there will be enough consumer demand to justify the expense. See Osterberg and Thomson (1998) for more details.

[12] Payment with e-money incurs two different costs for merchants: cost per transaction and cost per amount.

[13] For example, by reloading money from the merchant special terminal POS without the obligation of passing by a bank or an ATM.

[14] I thank an anonymous referee for this remark.

to use (David, 1994). Twenty years later, only 50% of factories used electricity in their production activities.

The spread of earlier payment innovations has also been slow. In 1995, only 15% of French citizens had a credit or a debit card; today, 89% have credit and debit and the number of users is still in growing. If one compares the current situation to these historical experiences, one could conclude that we may have to wait for a while to see the effects of a more widespread use of e-money innovations. One reason why the use of e-money could spread faster than in the past in the future is that the habit persistence problem can be more easily overcome in a knowledge-based, digital economy and society. The cashless society might therefore not be far away from us.

## 4 Conclusion

Advances in information and communications technology have enabled the appearance of new methods of electronic payment in the real world (card-based products) and the virtual world (software-card product). The reason for the spread of these products has been their greater effectiveness compared with the traditional payment systems. However, statistics on payment systems indicate that electronic money development is still at an early stage of development and that cash continues to be the most important means of payment for retail transactions. Thus, contrary to some early expectations, cash has not been yet replaced by electronic money.

This paper has tried to explain why electronic money has been not been in widespread use so far. One reason is that e-money is a fairly sophisticated form of money: its use requires investment in new payment technology by the retailers, and investment in the acquisition of new skills by the consumers. This paper has highlighted two additional reasons. The first is network externalities: as in the case of other innovations, the number of users of electronic money needs to attain a certain critical mass in order for a breakthrough in its usage to be achieved. The second problem hindering more widespread use of electronic money is the persistence of habit in using traditional forms of payment such as cash and cheques. If this habit persistence changed, it might become easier to attain the critical size of the network necessary for the spread of electronic money.

Governments could play a potentially significant role in changing the habit persistence problem and thus promoting the use of e-money. For instance, by encouraging the use of e-money in small transactions such as public parking meters and public transportation services, they could significantly increase the number of users of electronic forms of payment, helping to achieve the critical mass of users necessary to trigger network effects.

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