



---

# BANK OF FINLAND DISCUSSION PAPERS

---

8 • 2003

Hanna Jyrkönen – Heli Paunonen  
Financial Markets Department  
12.3.2003

Card, Internet and  
mobile payments in Finland

Suomen Pankin keskustelualoitteita  
Finlands Banks diskussionsunderlag

---

**Suomen Pankki  
Bank of Finland  
P.O.Box 160  
FIN-00101 HELSINKI  
Finland  
☎ + 358 9 1831**

**<http://www.bof.fi>**

---

# BANK OF FINLAND DISCUSSION PAPERS

---

8 • 2003

Hanna Jyrkönen\* – Heli Paunonen\*\*  
Financial Markets Department  
12.3.2003

## Card, Internet and mobile payments in Finland

The views expressed are those of the authors and do not necessarily reflect the views of the Bank of Finland.

The authors wish to thank all those who have taken the time to comment on various versions of the paper.

\* E-mail: [hanna.jyrkonen@bof.fi](mailto:hanna.jyrkonen@bof.fi)

\*\* E-mail: [heli.paunonen@bof.fi](mailto:heli.paunonen@bof.fi)

<http://www.bof.fi>

ISBN 952-462-043-X  
ISSN 0785-3572  
(print)

ISBN 952-462-044-8  
ISSN 1456-6184  
(online)

Suomen Pankin monistuskeskus  
Helsinki 2003

# Card, Internet and mobile payments in Finland

## Bank of Finland Discussion Papers 8/2003

Hanna Jyrkönen – Heli Paunonen  
Financial Markets Department

### Abstract

Retail payment methods are in a stage of rapid development. New service providers and technological developments enable new payment services through a variety of channels. Payment solutions are being developed based eg on the Internet and on mobile phones. Presumably, the use of paper-based payment instruments will decrease further in the future thanks to electronification in the retail payment area.

In this paper we focus on card payments in Finland and certain other countries. We also look at Internet- and mobile-based payments and discuss some of the challenges related to the new solutions. The paper ends with a brief discussion of recent changes in Finnish legislation in connection with retail payments.

Key words: retail payments, payment cards, Internet payments, mobile payments

# Kortilla, Internetissä ja matkapuhelimella maksaminen Suomessa

Suomen Pankin keskustelualoitteita 8/2003

Hanna Jyrkönen – Heli Paunonen  
Rahoitusmarkkinaosasto

## Tiivistelmä

Pienten maksujen maksutavat kehittyvät kaiken aikaa. Uudet palveluntarjoajat lisäävät kilpailua, ja kehittyvä tekniikka mahdollistaa maksupalvelujen tarjoamisen eri kanavien kautta. Esimerkiksi Internetin ja matkapuhelimen käyttöön perustuvia maksusovelluksia kehitetään jatkuvasti. Paperipohjaisten maksujen korvautuminen elektronisilla jatkuu myös tulevaisuudessa.

Keskitymme tässä keskustelualoitteessa kuvaamaan korttimaksamista Suomessa ja eräissä muissa maissa. Kuvaamme myös joitakin tapoja maksaa Internetissä ja matkapuhelimella sekä pohdimme uusien maksutapojen mahdollisia haasteita. Lopuksi luomme katsauksen viimeaikaisiin muutoksiin Suomen lainsäädännössä pienten maksujen alueella.

Avainsanat: pienet maksut, maksukortit, maksaminen Internetissä, maksaminen matkapuhelimella

# Contents

Abstract .....	3
Tiivistelmä .....	4
<b>1 Introduction .....</b>	<b>7</b>
<b>2 Payment cards .....</b>	<b>9</b>
2.1 Payment cards in Finland .....	9
2.1.1 E-money and prepaid cards .....	11
2.1.1.1 Multipurpose e-money cards .....	11
2.1.1.2 Single- or limited-purpose prepaid cards.....	12
2.1.2 ATM cards.....	13
2.1.3 Debit and online debit cards.....	13
2.1.4 Credit cards.....	14
2.1.4.1 Retailer cards .....	15
2.1.5 Combination cards.....	15
2.1.6 Loyalty cards .....	16
2.1.7 Comparisons of Finnish payment cards .....	16
2.2 International comparisons.....	18
<b>3 Internet and mobile payment solutions.....</b>	<b>24</b>
3.1 Internet payment solutions.....	25
3.1.1 Internet payments from a bank account in Finland.....	25
3.1.2 Customer account -based services.....	26
3.1.3 Internet payments by e-money .....	26
3.1.4 Internet payments by credit card .....	27
3.2 Mobile payment solutions .....	28
3.2.1 Services based on customer accounts.....	29
3.2.2 Purchase costs included in the phone bill.....	29
3.2.3 Dual chip and one chip solutions .....	30
3.2.4 International mobile payment solutions .....	30
3.3 Some concluding remarks on Internet and mobile payments.....	31
<b>4 Challenges for new payment solutions .....</b>	<b>32</b>
<b>5 Recent changes in Finnish legislation.....</b>	<b>34</b>
5.1 Implementation of directives concerning e-money .....	34
5.2 Implementation of the electronic commerce directive .....	34
5.3 Implementation of the directive on electronic signatures.....	35

<b>6 Summary</b> .....	<b>36</b>
References.....	38
Web pages.....	40
Appendix 1 .....	41
Appendix 2 .....	43
Appendix 3 .....	44



# 1 Introduction

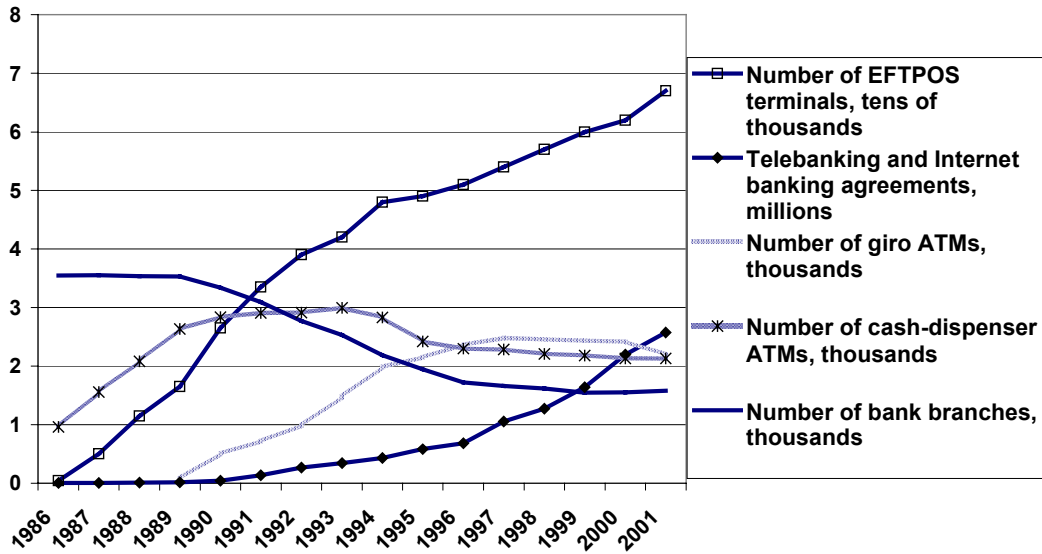
Retail payments are continuously developing, as electronic payments steadily replace paper-based payments. Many new payment services have come into existence in recent years, most of which are based on technical innovations such as mobile phones and Internet. In Finland, payments are electronified to a very high degree. For instance, almost everyone has a bank account and cheques are almost never used for making retail payments. One reason behind the wide electronification is that banks have used pricing effectively as a tool for inducing customers to use more efficient payment instruments. For instance, at the end of the 1980s cheques virtually disappeared from retail payments as banks began to charge fees on cheques and to actively promote debit cards that were free of transaction-based charge to the cardholder. Moreover, merchants had been actively investing in infrastructure, which enabled consumers to use their cards quite widely. The exit of cheques is a good example of the effectiveness of pricing in influencing household behaviour. Banks have also used pricing to create incentives for the use of credit transfers and self-service. At first, banks built up an extensive giro ATM<sup>1</sup> network for electronic credit transfers. Whereas the use of giro ATMs was free of transaction-based fees, the customer had to pay a fixed fee for each credit transfer at the bank counter. Today, bill payments at the counter are very expensive and the use of giro ATMs typically carries a cost to the customer, as banks are now using pricing to encourage customers to use Internet banking services. More information on developments in retail payments in Finland can be found eg in Saarinen (1996), Hatakka (1997), Snellman (2000) and Koskenkylä (ed., 2002).

---

<sup>1</sup> At an cash-dispenser ATM the customer is able to withdraw cash; giro ATMs are used to make credit transfers.

Figure 1.

### Finnish retail payment infrastructure



Source: Finnish Bankers' Association

Figure 1 shows some indicators of electrification for the Finnish retail payment infrastructure. The numbers of EFTPOS<sup>2</sup> terminals and telebanking and Internet banking agreements have been increasing very rapidly. The number of bank branches has decreased sharply, as a part of the structural change in the early 1990s; and the number of cash-dispenser ATMs also declined, especially between 1993 and 1996. Recently, the number of giro ATMs has also started to decrease. Obviously, the infrastructure depends on payment habits and vice versa. At the beginning of the 1980s people went to the bank to handle their banking affairs. Later they began to withdraw cash from ATMs and to make credit transfers at giro ATMs instead of going to a bank branch. The number of telebanking and Internet banking agreements increased enormously during the 1990s, and today more than half of the Finnish population has made such an agreement. The use of Internet banking services in particular has been increasing in Finland during the past few years. Changes in pricing of banking services have obviously had an important influence on developments in bill payments. As a conclusion, figure 1 indicates the electrification trend of retail payments in Finland.

The aim of this paper is to describe and briefly analyse recent trends in card, Internet and mobile payments. We concentrate on card payments because cards have been used for a long time in Finland. And, since international data on card payments are available, we compare card payments in Finland to those in other

<sup>2</sup> Electronic Fund Transfer at Point of Sale. EFTPOS terminal is a terminal that is located in a store, petrol station, etc in which eg the recognition of cards, checking of lists of cancelled cards and the transmission of card payments is automated (Bank of Finland, 1993).

countries. The use of payment cards is very popular in Finland and the share of card payments in all cashless transactions was 38.7% in 2000. Appendix 1 includes information on the relative importance of payment cards and other retail payment methods in Finland and some other countries. There are no comparable data available on Internet and mobile payments because many solutions are still in the pilot phase. However, it is interesting to look at various solutions and consider the possible differences and similarities. Furthermore, we consider some challenges related to new solutions and discuss some recent changes in relevant Finnish legislation.

The structure of the paper is as follows. In section 2 we discuss payment cards used in Finland and make some international comparisons of the use of debit and credit cards. In section 3 we concentrate on Internet and mobile payments, mainly in Finland, and in section 4 we discuss possible challenges inherent in the new ways of making payments. Recent implementation of relevant EU directives in Finland is briefly discussed in section 5, and section 6 summarises the paper.

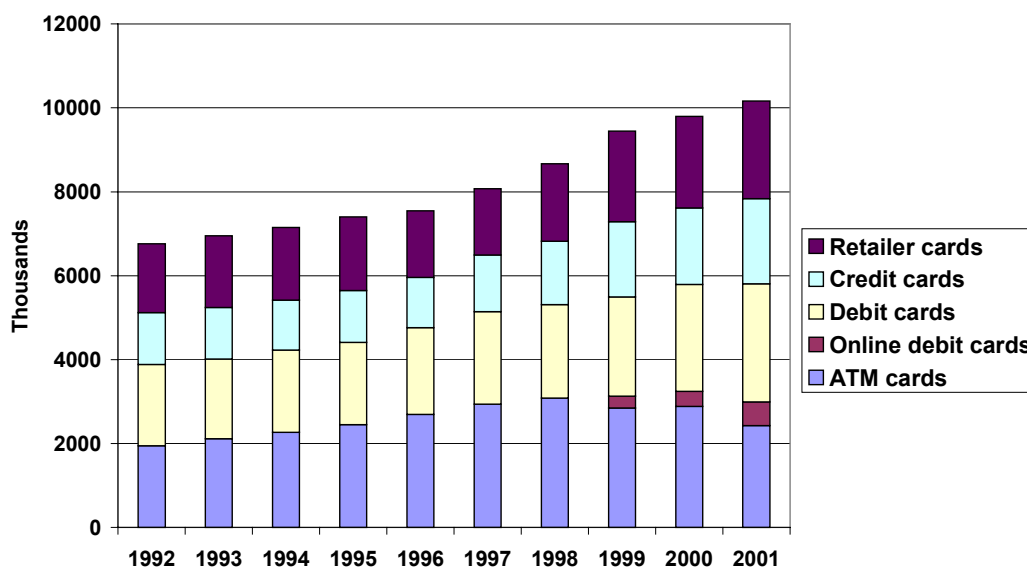
## 2 Payment cards

In this section we look at developments in various types of payment cards. We start by discussing and classifying payment cards in Finland, after which we make some comparisons on card usage in Austria, Belgium, Denmark, Finland, France, Germany, Netherlands, Sweden, UK and USA.

### 2.1 Payment cards in Finland

Figure 2 shows the number of payment cards in Finland by feature. Because the customer is able to combine many features in the same card, it is not appropriate to look merely at the number of cards in circulation. For example, it is often the case that the same physical card functions as debit card, credit card and ATM card. As seen from figure 2, the number of different card features totalled ca 10 million in 2001, which implies nearly two features per inhabitant.

Figure 2. **Number of cards by feature<sup>3</sup>**



Source: Finnish Bankers' Association

In the next few sections we will discuss differences and similarities in the functions of different cards. We will not discuss in detail card prices, which do vary somewhat depending on card features and issuer. For instance, ATM and debit cards are typically free of charge for customer, whereas credit cards involve various annual fees and sometimes other fees that depend on card type and issuer.

---

<sup>3</sup> Retailer cards can be used in certain stores depending on the issuer. Credit cards can be used in many retail chains, regardless of issuer. Credit cards can be used as revolving credit cards or delayed debit cards (charge cards or deferred debit cards). Debit cards (bank cards) can be used for cash withdrawals and credit transfers at ATMs, as well as for payments at EFTPOS terminals throughout Finland. Online debit cards are authorised in real time and can be used for ATM and EFTPOS transactions both in Finland and abroad. ATM cards can be used for ATM cash withdrawals and credit transfers at giro ATMs in Finland.

## 2.1.1 E-money and prepaid cards

Electronic money<sup>4</sup> schemes can be divided into software- and card-based. In this section we discuss card-based e-money, and software-based e-money will be discussed in section 3.1.3. Card-based e-money refers to the monetary value that is stored on a chip card for use as a multipurpose means of payment. Furthermore, there are many single- or limited-purpose prepaid cards in Finland.

### 2.1.1.1 Multipurpose e-money cards

Only one multipurpose e-money scheme – Avant – is used in Finland ([www.avant.fi](http://www.avant.fi)). Avant cards, as well as e-money value, are issued by the three biggest Finnish banks (Nordea, Sampo and OKO Bank). The system is operated by Automatia Rahakortit Ltd, which is a company jointly owned by these e-money issuer banks. The current phase of Avant e-money scheme was launched in March 1997. The first phase had been launched in 1994 by Toimiraha Ltd, then a subsidiary of the Bank of Finland but later sold to the above-mentioned banks and renamed Automatia Rahakortit Ltd. Avant cards were initially disposable but are nowadays all reloadable.

Customers are able to load and unload their cards at most Finnish ATMs ('Otto.' network) or via Internet, provided the card holder has the appropriate card reader and software. A service fee is charged for loading and unloading e-money. From 1997 to 2000, every reloadable Avant card was tied to a specific bank account, and customers could get the e-money application only on the same chip card with their ATM, debit or credit card functions. Nowadays, there are also reloadable Avant e-money cards that are not tied to specific bank accounts. Instead, the same card can be loaded from several bank accounts with e-money that is issued by Automatia. These Avant 'co-branded cards' can include certain other functions.

The customer can pay by Avant card at some 6,000 terminals, and e-money is especially suitable for small and quick transactions. At the end of 2002, there were about 900,000 chip cards in circulation that included the Avant card function along with a debit or credit card function. However, the use of e-money is at a

---

<sup>4</sup> According to the ECB (1998), electronic money is broadly defined 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.

In directive 2000/46/EC electronic money is defined as monetary value represented by a claim on the issuer which is (i) stored on an electronic device; (ii) issued on receipt of funds of an amount not less in value than the monetary value issued; (iii) accepted as means of payment by undertakings other than the issuer.

very low level in Finland. One reason for this is that Finnish consumers are accustomed to paying with other payment cards, especially with debit cards, that can also be used for small payments. Furthermore, debit and credit cards are more widely accepted by merchants than e-money cards. Pricing may also have an impact on the use of e-money, since the customer has to pay for loading or unloading e-money. Because e-money is not widely used and there are good substitutes for it, merchants are not willing to invest in terminals. This reduces the incentive for potential customers to use e-money. The existence of such a chicken-or-egg problem seems to be quite obvious as regards e-money schemes.

For the time being, the use of e-money in general is at a low level<sup>5</sup> in the euro area. However, some initiatives to promote interoperability in this field have been launched. The Common Electronic Purse Specification (CEPS) is an international project aimed at advancing worldwide interoperability between various e-money schemes.

#### 2.1.1.2 Single- or limited-purpose prepaid cards

There are also many single- or limited-purpose prepaid cards in circulation. The former can be used only for making payments to the card issuer and the latter are limited eg to certain areas or stores. These cards can be disposable or reloadable. Reloadable purses can be loaded and unloaded at special terminals.

Some Finnish examples of limited-purpose prepaid card systems are city cards, UniCard and KeyCard. City cards, which are in use in some Finnish cities, can presently be used to pay for a very limited range of services. The aim is to expand the range of services provided by municipalities. UniCard ([www.unicard.fi](http://www.unicard.fi)) is issued by the student association of the Helsinki University. UniCard is combined on the same chip card with the student card function and can be used on university premises, eg in restaurants and bookshops. At the beginning of 2003 there were about 40,000 UniCards in circulation. KeyCard is a prepaid card system that is used at two Finnish ski resorts, Pyhä ([www.pyha.fi](http://www.pyha.fi)) and Ruka ([www.ruka.fi](http://www.ruka.fi)). Customers can use their KeyCards to pay for certain services on the ski resort premises.

---

<sup>5</sup> According to the ECB (2002b), card-based e-money is relatively unimportant among cashless payment instruments in Europe. The share of card-based e-money transactions in the total number of cashless transactions is highest in Luxemburg (6.3% in 2000) and second highest in Belgium (3.6% in 2000). On the other hand, the share of card-based e-money transactions in the total value of cashless transactions is very low, being highest in Denmark and Sweden (0.002% in 2000). It is noteworthy that there is a lack of data on e-money transactions for many countries.

## 2.1.2 ATM cards

Finnish banks issue ATM cards, which can be used only for ATM cash withdrawals and credit transfers at giro ATMs in Finland. There were ca 2.4 million ATM cards in circulation at the end of 2001. Furthermore, almost all debit and many credit cards include an ATM card function. In Finland 85%<sup>6</sup> of all cash withdrawals are made at ATMs. The number of ATM withdrawals was 248 million in 2001 and the average value of a withdrawal was ca EUR 70.

## 2.1.3 Debit and online debit cards

Debit cards were first issued in Finland in spring 1980. Now, debit cards are in wide usage and are issued by all banks that have private customers. These cards can be used for cash withdrawals and credit transfers at ATMs, as well as for making payments at EFTPOS terminals or by using an imprinter in shops throughout Finland<sup>7</sup>. When paying by debit card, the customer validates the purchase by signature or PIN code, depending on the merchant's terminal. The sum is debited from the customer's bank account within a few days. There are also some security checks, like checking the customer's identification or the list of cancelled cards and authorisation of transaction. In addition to conventional debit cards, international online debit cards are used to some extent in Finland.

The only online debit card issued in Finland is Visa Electron, which has been issued by Finnish banks for several years. All Visa Electron transactions are debited from the customer's bank account. At first, customers were able to use these cards for cash withdrawals at ATMs in Finland and abroad and for credit transfers at giro ATMs in Finland. Since May 2000, it has also been possible to make payments with these cards at EFTPOS terminals in Finland and abroad. At the end of 2002 there were ca 814,000 online debit cards in circulation and ca 25,000 Finnish merchants were accepting these cards. Compared to the conventional domestic debit card, the advantage of an online debit card is the real-time authorisation. With real-time authorisation, the customer cannot make purchases valued in excess of the balance on the associated bank account. Accordingly, also people who cannot or do not want to have a conventional debit card may find this type of payment card useful.

---

<sup>6</sup> Talouselämä 31 Aug 2001.

<sup>7</sup> In recent years, some banks and some merchants have agreed to enable cash withdrawals at POS with domestic debit cards. This service has not yet reached a high usage level.

Costs charged to customers for making Visa Electron transactions were recently changed, following the regulation on cross-border payments in euro<sup>8</sup>. According to article 3 of the regulation, ‘with effect from 1 July 2002, charges levied by an institution in respect of cross-border electronic payment transactions in euro up to EUR 12,500 shall be the same as the charges levied by the same institutions in respect of correspondent payments in euro transacted within the Member State in which the establishment of that institution executing the cross-border electronic payment transaction is located’. In other words, the regulation requires eg that charges for making payments or cash withdrawals by online debit card, or by any other international payment card, cannot be higher in other euro area countries than they are in the customer’s home country. From 1 July 2003 the regulation will also apply to cross-border credit transfers in euro up to EUR 12,500. From 1 January 2006 the amount EUR 12,500 will increase to EUR 50,000. The aim of the regulation is to develop the single European market and improve the efficiency of cross-border retail payments between euro area countries.

#### 2.1.4 Credit cards

Credit cards (general purpose credit cards) can be used in many retail chains, regardless of card issuer. Many such credit cards are used in Finland. The main features of these card schemes are quite similar. However, there are some differences eg in credit limits and fees. Customers can also use their credit cards as delayed debit cards (charge cards, deferred debit cards) if they want to pay the whole sum on the first invoice. Actually, some credit cards have been used as delayed debit cards for a long time, but more recently cardholders have also been given the possibility to use their cards as revolving credit cards ie to pay the balance in portions. This enables card issuers to earn interest income on card balances. According to Statistics Finland (2002), interest income was about half of all fees charged for using credit cards in 2001.

The most popular credit card in Finland is Visa. There were over one million Visa cards in circulation at the end of 2001. Earlier Visa cards were used as delayed debit cards, but since 2001 customers have been able to opt for a Visa card with a credit function. To use a Visa card, the customer pays an annual fee dependent on card product. Visa cards are issued by Luottokunta, which is a credit institution owned jointly by merchants and banks.

Many other international credit cards are also commonly used in Finland. The issuing of Eurocard/MasterCard to private customers was started by the largest

---

<sup>8</sup> Regulation (EC) No 2560/2001 of the European Parliament and of the Council on cross-border payments in euro.



Finnish banks for some years ago, and the market share of these cards has been growing rapidly during recent years. American Express cards are also issued in Finland, and they are used as delayed debit cards. Diners Club cards are also available in Finland, and certain international cards are accepted by some Finnish retailers, even if these are not issued in Finland.

In addition to international cards, there are several domestically used credit cards such as Tiliraha, Käyttöluotto and Aktiiviraha, which can be used for making payments in thousands of shops in Finland. All these cards are issued by credit card companies, which are mainly subsidiaries of the banks operating in Finland.

Some banks' customers are able to attach certain special features to their credit cards. This could be part of card issuers' marketing or public relations activities. For instance, Nordea issues MasterCard 'affinity cards', in connection with certain icehockey teams, and a portion of the annual fees for the cards goes to support junior coaching. It is also possible to combine some labour union cards with MasterCard. Some credit card schemes include the possibility to transfer money from credit account to bank account, and with some credit cards it is possible to withdraw cash from the credit card account at domestic ATMs.

#### 2.1.4.1 Retailer cards

Retailer cards can only be used in certain stores, depending on card issuer. Some examples of retailer cards are oil companies', furniture chains' and travel agencies' cards. There are many different cards in circulation because the paying possibilities for a single card are very limited.

Many retailer cards are used by private firms. According to Statistics Finland (2002) private firms owned 20.6% of all active retailer card accounts and made as much as 60.1% of all retailer card purchases in 2001. Corresponding figures for credit cards were 6.6% and 16.3%. One reason for the popularity of firms' retailer card usage could be gas station cards that are very commonly used by private firms.

#### 2.1.5 Combination cards

In Finland several payment functions can be combined in a single card. For instance, a customer may be able to have debit and credit card applications and the Avant e-money function in the same card. Furthermore, it is possible to include certain loyalty card features in some debit and credit cards. In the future, the transition from magnetic stripes to chip cards will increase memory and

security<sup>9</sup>. Increased memory presents new possibilities for combining many different card functions, as well as security features, into one chip. It is also more difficult to counterfeit chip cards than cards with a magnetic stripe. Furthermore, functions can be changed without changing the whole card.

### 2.1.6 Loyalty cards

Some retail chains have their own loyalty cards. Loyalty card schemes vary depending on the retail chain. Next we look at common features of some of these schemes.

A loyalty card holder may have the benefit of either discounts or bonuses tied to purchases. Bonuses may be paid in the form of vouchers or directly into a bonus account or into a card holder's bank account. The customer can then use the bonus for purchases in the card issuing retail chain. Some retailers allow customers to convert bonuses into cash and withdraw cash at EFTPOS. The use of loyalty cards is normally limited to stores owned by the issuer and perhaps to some of its business partners.

Some retail chains have loyalty credit cards that can be used as credit cards or delayed debit cards. Furthermore, some retail chains have accounts into which customers may be able to transfer money from bank accounts. Having done so, a customer is able to pay for purchases from stores belonging to the same retail chain.

### 2.1.7 Comparisons of Finnish payment cards

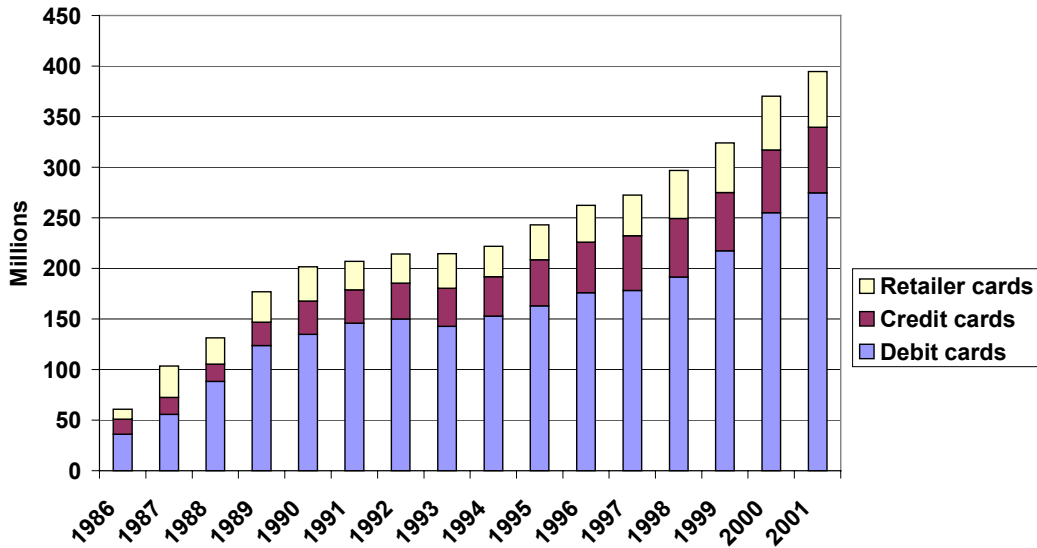
As seen in figure 2 on page 10, the numbers of almost all types of cards in circulation have increased during the observation period, the only exception being the number of ATM cards, which has decreased in the last few years. However, the value and number of ATM cash withdrawals have continued to increase. One reason behind decreased number of ATM cards could be that people may have had many different cards which include the ATM function. Recently, banks have started to charge fees for customers who hold more than one card per bank account and, therefore, customers may have returned passive cards to banks.

---

<sup>9</sup> Europay, MasterCard and Visa have defined a standard for migrating from magnetic stripe-based cards to chip cards (EMV). The migration schedule in the EU is to issue international payment cards on chip by 2005. In Finland the EMV standard applies to internationally branded Visa, Visa Electron, Eurocard and MasterCard. For domestic debit cards there is no fixed migration schedule at the moment but they will follow the international development.

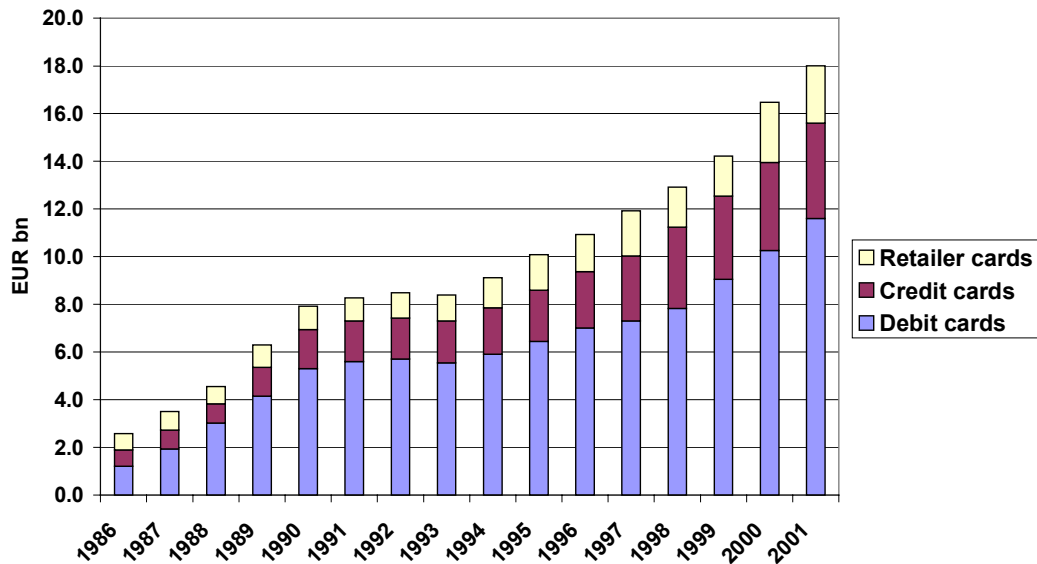
Figures 3 and 4 show the numbers and values of payments by debit, credit and retailer cards, respectively.

Figure 3. **Number of card transactions**



Source: Finnish Bankers' Association

Figure 4. **Value of card transactions**



Source: Finnish Bankers' Association

As seen in figure 2, the number of retailer cards in circulation is almost the same as the number of debit cards in circulation. Figures 3 and 4 show that in 2001 the number and value for debit card transactions were both about five times as much as for retailer cards. The reason for this could be that retailer cards can be used only in a few shops, eg in gas stations, whereas debit cards are widely accepted. According to the Finnish Bankers' Association (2002), on average debit cards were used 97 times and credit cards 32 times in 2001. Similarly, only 24 payments were made with each retailer card. The average value of total payments per card in 2001 was also much higher for debit cards (EUR 4,117 per year) than for credit and retailer cards (EUR 1,967 and EUR 1,018 per year, respectively). As these figures show, credit cards are used less frequently than debit cards, but the average value of a credit card payment seems to be somewhat higher. One reason for this could be that commodities paid for with credit cards are typically more expensive than those paid for eg with debit cards. In other words, people typically pay for everyday purchases like food with debit cards but use credit cards to pay for more expensive durable goods such as furniture and household appliances.

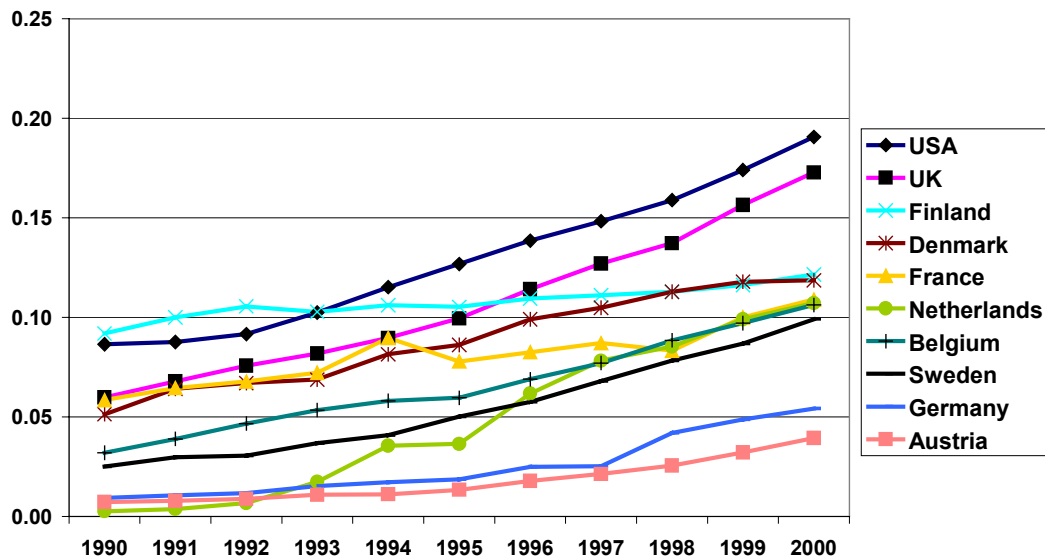
As figures 3 and 4 show, the absolute number and value of card payments in 2001 were ca six times what they were in 1986. The increase was very rapid at the end of the 1980s because of a decline in the use of cheques. The increase in card payments stopped at the beginning of the 1990s due to Finland's severe economic depression. Since the depression the use of payment cards has increased quite rapidly, especially during the last few years. Use of payment cards will probably continue to increase because of the transition to euro cash. Banks and credit card companies ran large-scale campaigns promoting the use of payment cards instead of cash. At the end of 2001 issuance of payment cards increased greatly and so it is possible that new card holders will start to use their cards. Even if the absolute number and value of card payments have increased, it is interesting to examine the importance of card payments eg relative to GDP or private consumption. In the next section we will discuss some relative figures and make some cross-country comparisons.

## 2.2 International comparisons

Next, we compare the Finnish payment card data to data from certain other countries. Because of the lack of data in some countries we look only at debit and credit card payments. The countries included are Austria, Belgium, Denmark, Finland, France, Germany, the Netherlands, Sweden, the UK and the USA. We have also some data on EU averages. The data<sup>10,11</sup> consist of the debit and credit

card purchases (numbers and values), GDP, private consumption, and numbers of inhabitants and EFTPOS terminals from 1990 to 2000.

Figure 5. **Value of card payments relative to GDP**



Source: ECB, EMI and BIS

Figure 5 shows that in 2000 the ratio of the value of debit and credit card payments to GDP was highest in the USA and UK. In the USA this ratio increased from 9% to 19% during 1990–2000. Credit cards have been a popular payment medium in the USA during the whole period, even though the use of cheques is still more common (appendix 1). However, according to Chakravorti and McHugh (2002), at points-of-sale credit cards have now surpassed cheques as the most popular payment instrument. In the UK the ratio increased from 6% to 17%, ie the ratio has almost trebled during the period. This development can also be explained by the diminished use of cheques. Appendix 1 includes information on the use of payment cards and other cashless retail payment instruments. Based on figures and tables in appendix 1, payment cards seem to be replacing cheques in many countries.

At the beginning of the period, the ratio of card payments to GDP was highest in Finland. However, this ratio increased only a little, from 9% to 12%, during the observation period. One reason might be that Finnish consumers were quite used to card payments already in the 1980s. The rapid increase in card payments at the

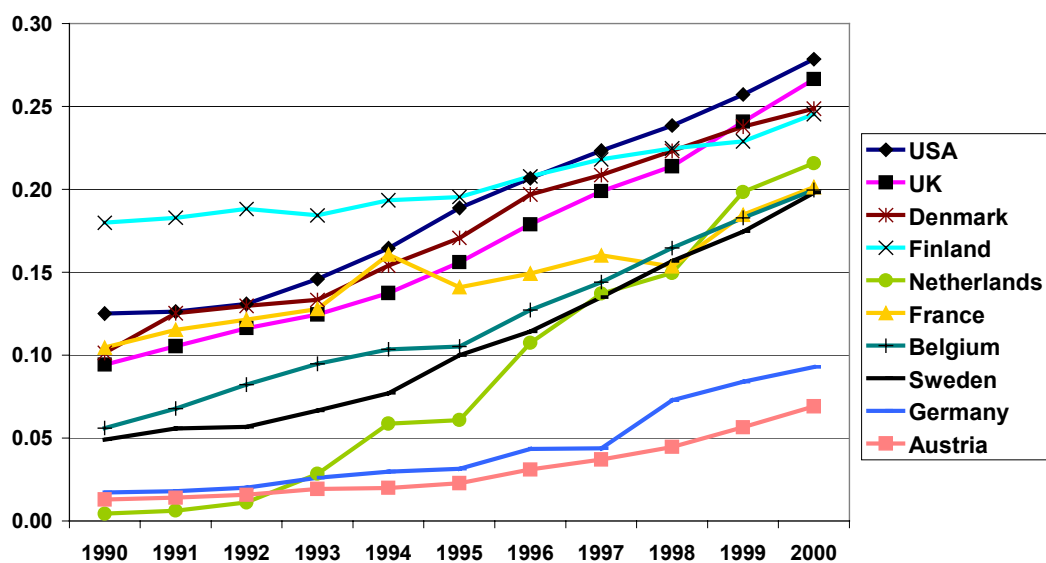
<sup>10</sup> The data are based on EMI (1996) and (1998), ECB (2001) and (2002b), BIS (1995), (2001b) and (2002) and IMF (2001).

<sup>11</sup> The absolute numbers and values of card payments, as well as the annual changes in these figures, can be found in appendix 2.

end of the 1980s' can be seen in figures 3 and 4. Banks started to charge a fee for using cheques as a payment medium in 1988 and, at the same time, banks issued debit cards to customers free of transaction-based charge. On the other hand, it was easy to pay by card, because many merchants were accepting payment cards. Another reason for the slower increase in Finland in card payments relative to GDP than in other countries could be that there has been no room to substitute cards for cheques in non-POS payments because these transactions are typically paid by credit transfers in Finland. The popularity of credit transfers in Finland can be seen in appendix 1. As seen in table A1.1 in appendix 1, the number of credit transfers per inhabitant has increased very much in Finland over 1990–2000. Furthermore, differences in GDP growth rates between countries vary and this naturally has impact on the ratio of the value of card payments to GDP. For instance, in Finland the value of GDP decreased at the beginning of the 1990s and increased rapidly over the latest years of the observation period. This could be also one reason for the flat curve of the Finnish ratio.

The use of debit and credit cards is at a low level in Austria and in Germany. According to Mooslechner et al (2002), Austrians still prefer cash payments and payment habits seem to change very slowly. One reason for low usage of cards in Germany might be that merchants have quite high values for minimum credit card payments. Also wide use of other payment methods and differences in payments paid by different payment methods may explain the low use of payment cards. For instance, the use of direct debits is very popular in Germany (appendix 1).

Figure 6. **Value of card payments relative to private consumption expenditures**

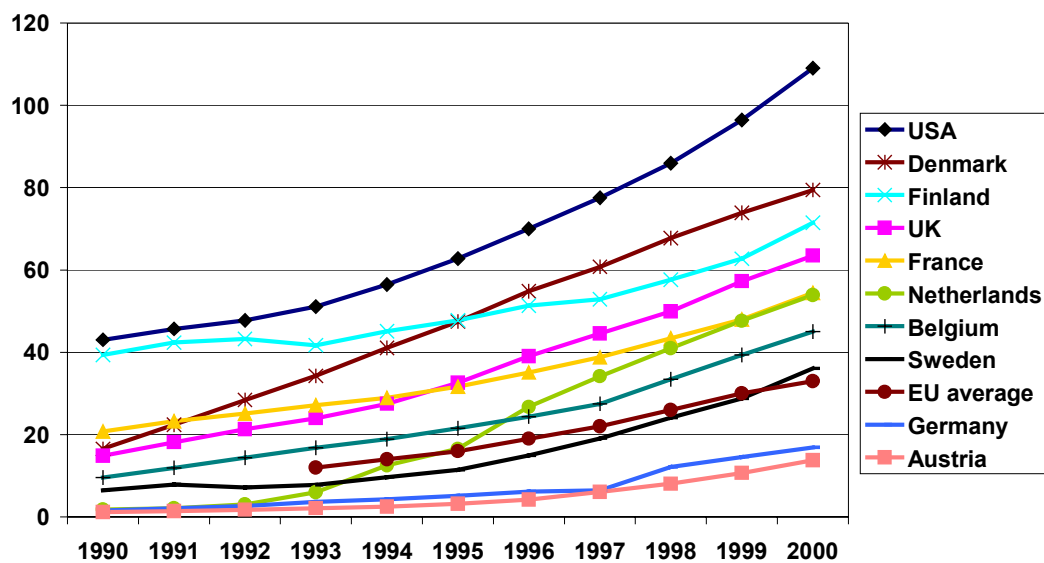


Source: ECB, EMI, BIS and IMF

It is also interesting to compare the value of card payments to private consumption expenditures. This ratio increased in all countries during 1990–2000, and the order is not much different than in figure 5. In 2000 the ratio was 28% for the USA, 27% for the UK and 25% for Finland. As seen from figure 6, the gap between Finland and the USA is narrower than in the previous figure. This depends on the differences in the ratios of private consumption to GDP. In Finland private consumption amounts to about half of GDP and in the USA about two-thirds during the observation period. Perhaps private consumption is a better denominator than the GDP because we are interested in the portion of purchases paid by payment cards. On the other hand, card usage by companies or state may differ between countries and, therefore, private consumption may not be the best denominator.

Another interesting way to study the importance of card payments in various countries is to compare number of card payments to population. This collation is illustrated in figure 7.

Figure 7. **Number of card payments per inhabitant**



Source: ECB, EMI and BIS

Figure 7 shows that the number of card payments per inhabitant has constantly been highest in the USA during the whole observation period. The figure increased from 43 to 109 over 1990–2000. The number of card payments per inhabitant was also high in Denmark, Finland and UK in 2000. As mentioned earlier, growth may have been rapid in the USA and UK because of the declining share of cheques in retail payments (appendix 1). Another explanation for the high number of card payments per inhabitant in the USA could be that Internet

purchases and mail orders are often paid for by credit card. For Denmark appendix 1 indicates that the use of credit transfers and cheques has decreased there while the use of payment cards increased over the period 1990–2000.

In Finland the number of card payments per inhabitant rose from 39 to 71 during 1990–2000. The growth has not been as rapid as in the USA or Denmark, partly because Finnish consumers were used to making card payments already at the end of 1980s. It is interesting that the number actually declined in 1993. Probably this was due to the severe depression in the Finnish economy in the early 1990s. Many people had to return their payment cards to the card issuers because of financial problems.

Figures are available on EU averages since 1993. As seen, the number of card payments per inhabitant increased from 12 to 33 during 1993–2000. The EU average seems to have been at a low level compared to many other countries in figure 7. Of the countries studied, card payments per inhabitant are lowest in Germany and Austria. This result is similar to those shown in figures 5 and 6.

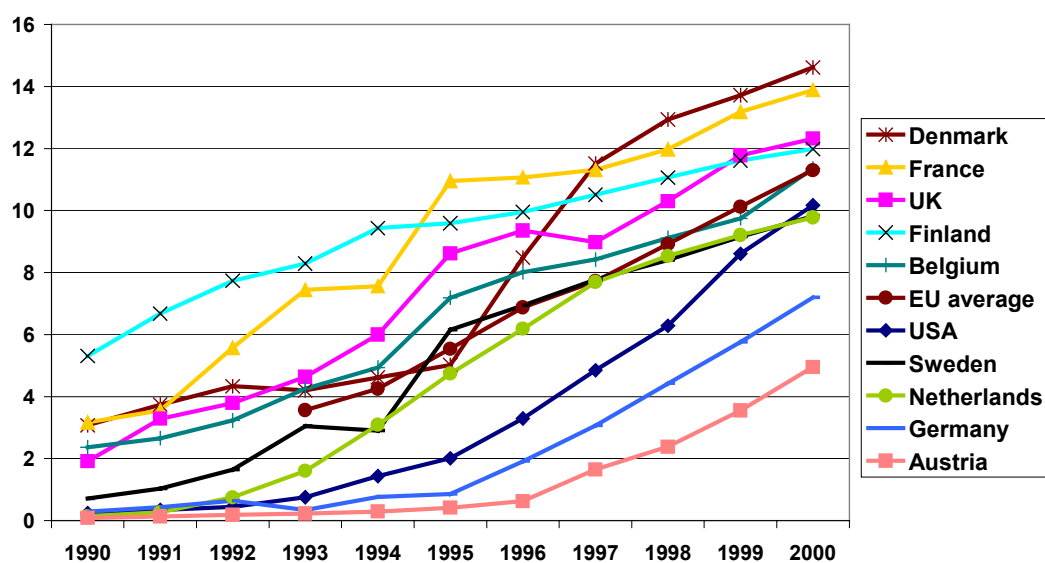
As can be seen from appendix 1, the number of cashless transactions per inhabitant has increased rather much in all countries during the observation period. This may indicate that the total number of payment transactions has increased or that the number of cash transactions has decreased. However, there are no statistics on the number of cash transactions because cash is in open circulation and so not all cash transactions can be traced. Moreover, some portion of cash is in passive use.

Besides comparing the value and number of card payments, it is also interesting to find out how easily people can use their payment cards. One indicator for this could be the number of EFTPOS terminals. Naturally, POS card payments can also be processed by using an imprinter. Figure 8 shows the path of the number of EFTPOS terminals per 1000 inhabitants in selected countries.



Figure 8.

### Number of EFTPOS terminals per 1000 inhabitants



Source: ECB, EMI and BIS

The growth of EFTPOS terminals per 1000 inhabitants has been rapid in all the countries during the observation period. In 2000, Denmark reached the highest level for these countries, almost 15 terminals per 1000 inhabitants, followed by France, where the number of EFTPOS terminals grew from 3 to 14 terminals per 1000 inhabitants during 1990–2000. In the UK the number of EFTPOS terminals increased from 2 to 12 terminals per 1000 citizens. The number of terminals rose very sharply also in the USA, especially over 1994–2000. The result may be somewhat surprising in light of figures 5–7 because the use of payment cards was highest in the USA. One reason for this could be that all terminals are not included in the number of EFTPOS terminals<sup>12</sup> in figure 8. On the other hand, American consumers may have paid eg for Internet purchases more often by credit card than did European consumers.

During 1990–1994 the number of EFTPOS terminals per inhabitant was highest in Finland. This is reasonable because cheques had disappeared from retailers at the end of 1980s and merchants had been investing early in payment infrastructure. The EU average for EFTPOS terminals per 1000 inhabitants increased from 4 to 11 over 1993–2000. Austria and Germany seem to have the lowest ratios of EFTPOS terminals per 1000 inhabitants, 7 for Germany and 5 for Austria in 2000. However, in both countries the number of EFTPOS terminals seems to have increased since 1995 and card payments could increase in the future, thanks to investments in EFTPOS infrastructure.

<sup>12</sup> The data available for the USA include only pin-based EFTPOS terminals (BIS 2002).

To sum up, the value and the number of card payments increased remarkably in most of the observed countries during 1990–2000. Also the card infrastructure has been developing quickly. Obviously, there is a trend toward electronification in the countries studied. The USA, UK, Finland and Denmark are the ‘top-four’, although the order has changed during the period. In the USA, Denmark and UK the development has been much more rapid than in Finland during the most recent years. As stated earlier, credit transfers are very popular in Finland. Furthermore, the use of payment cards and investments in infrastructure increased in Finland already at the end of the 1980s. One reason behind this was that banks encouraged the use of debit cards via pricing policy. Some reasons behind the high level of electronification and some indicators of electronification were discussed in section 1. Can one expect that the development of electronification would be similar also in other countries? Would the speed and pattern of electronification differ eg between ‘cheque countries’ and ‘giro countries’? Besides payment cards, there are also other payment methods that could replace paper-based payment methods to some extent. In the next section we discuss Internet payments and payments via mobile phone.

### 3 Internet and mobile payment solutions

The use of the Internet has increased very rapidly in Finland during the last decade. OECD study (2002) shows the number of Internet hosts in OECD countries per 1000 inhabitants in July 2001. This figure for Finland totalled ca 180, which was exceeded only by the USA’s ca 270. Mobile phone penetration is also very high in Finland. The number of mobile subscribers per 100 inhabitants was 80.4 in 2001<sup>13</sup>. Wide Internet and mobile phone penetration makes it possible to offer eg banking services via these devices. For instance, the use of Internet-based banking services is very popular in Finland and some banking services are also available via digital TV or PDA<sup>14</sup>. In the USA many companies provide Internet-based person-to-person payment services as substitutes for cheques.

Next we discuss some solutions for making payments via the Internet or mobile phone. We have selected some examples from Finland and abroad at the beginning of 2003. In fact, it is not a simple matter to classify payments as Internet or mobile payments. For instance, if a consumer uses Internet banking services via his WAP phone, is this Internet banking or mobile banking? In other words, there are many devices for accessing the same services. Services could also be classified according to service provider. For instance, payment services

---

<sup>13</sup> Ministry of Transport and Communications Finland, [www.mintc.fi](http://www.mintc.fi).

<sup>14</sup> Personal Digital Assistant.

have traditionally been provided by banks in Finland. During the recent years also non-banks, such as telecom operators, have started to provide payment services, and so competition has increased.

### 3.1 Internet payment solutions

In Finland customers can use several different payment methods for transacting on the Internet. These include payments from a deposit account or customer account<sup>15</sup>, credit cards and e-money. In this section we will discuss these methods using a few examples from Finland and some other countries.

#### 3.1.1 Internet payments from a bank account in Finland

As mentioned earlier, Finnish banks have used pricing to encourage customers to use self-service. Almost all banking services can be accessed via Internet in Finland. E-banking developments in the Nordic countries are discussed eg in Leinonen (2003). Finnish banks have also developed a secure payment solution for e-commerce based on an Internet banking solution. When a customer is at an e-store site and wants to buy something, he clicks on the Internet payment button of his bank and is transferred to the bank's website, where he accepts the bill, after which his bank account is debited in real time. The funds are also credited to the merchant in real time.

Despite the secure payment solution, e-commerce has not gained wide popularity in Finland. According to an OECD (2002) study, there are many reasons why people are unwilling to make purchases from e-stores. In Finland the main barriers to e-commerce seem to be that there are no suitable goods for e-commerce and customer potential is too small. The third reason, according to the OECD (2002), is that customers feel insecure about payments. The situation is quite similar in Sweden, Norway and Denmark (OECD 2002). In addition to these reasons, service providers may have had logistical problems with commodities bought via Internet. Many mail-order companies with more effective logistical networks have started to supply their commodities also via Internet in Finland.

---

<sup>15</sup> 'Customer account' here means an account that is not covered by deposit guarantee and so cannot be called a 'deposit' account. Customer accounts can be provided by either banks or non-banks.

### 3.1.2 Customer account -based services

Many money transfer systems based on the Internet and email addresses have become operative in recent years. Currently, the most common and best-known non-bank system may be PayPal, which was launched in the USA in 1999. The customer needs an email address and a PayPal account to be able to send money. First, the customer transfers funds to his PayPal account. He then logs onto the PayPal system and enters into a form the receiver's email address and the monetary amount. After this, the receiver gets an email concerning the money transfer and a credit to his existing, or just-created, PayPal account. In addition to person-to-person money transfers, the customer can use his PayPal account eg to make purchases, withdraw money in cheque form, or transfer money back to his bank account ([www.paypal.com](http://www.paypal.com)). PayPal has succeeded mainly because of its popularity in Internet auctions. In 2001 as much as 66.9% of PayPal transactions originated from Internet auctions (McHugh 2002). Online market eBay acquired PayPal in October 2002.

Some Finnish services are also based on customer accounts. One example is OKO Bank Group's Digiraha, which was launched in November 2002. According to OKO Bank Group, Digiraha should be especially useful for small Internet payments. The customer opens an account and transfers money to it from his bank account. A Digiraha account differs from a bank deposit account in that it is not covered by the deposit guarantee and the value per account cannot exceed EUR 250. Thereafter, the customer is eg able to make payments, transfer money to other Digiraha account or transfer money from a Digiraha account back to his bank account via the Internet or mobile phone. ([www.digiraha.net](http://www.digiraha.net)). In other words, this service has features of both Internet and mobile payments. Certain other services are available in Finland that are account-based and accessible via mobile phone. We will discuss some of these services in section 3.2.1.

### 3.1.3 Internet payments by e-money

Some card-based e-money schemes can also be used for Internet payments at certain Internet sites. For instance, the Finnish Avant e-money has been piloted for Internet payments. This solution requires the customer to have an appropriate card reader and software. E-money could be an easy and secure way of paying for Internet services but there seem to be some problems. For instance, the number of products and services available is very limited and customers are not willing to invest in the extra equipment required.

Besides card-based e-money, some software-based e-money schemes have come on stream in some countries. For the time being, there are no software-based e-money schemes in Finland. EUNET e-cash, which started operations in March

1996, was terminated in autumn 1998. Overall, the number of software-based e-money schemes is very low throughout the euro area (BIS 2001). One example of network/software-based e-money cited in BIS (2001) is the Italian Omnipay prepagato scheme. In this system a customer buys a scratch card that includes a PIN code. With this code the customer can make Internet purchases anonymously. The value of e-money that a customer can use for purchases is that which he paid for the scratch card. ([www.omnipay.190.it](http://www.omnipay.190.it)) Other schemes similar to Omnipay prepagato have also come on stream in some other countries.

The definition of electronic money in directive 2000/46/EC (footnote 3) is well suited for card-based systems but may be somewhat problematic for softwarebased systems because the interpretation of software-based e-money seems to differ across countries. According to ECB (2002), 'software-based e-money schemes are based on tokens, which can be described as 'digital coins'. The tokens (or coins) are obtained from a payment service provider via the Internet and are stored in a digital wallet on the user's PC'. ECB (2002) classifies prepaid payment services as (i) e-money schemes (both card-based and software-based schemes), (ii) personal online payment services and (iii) prepaid cards. Schemes like Omnipay prepagato have been classified as prepaid cards rather than e-money schemes. The definition of software-based e-money according to ECB (2002) seems to be compatible with the implementation of the e-money directive in Finland. The amended Credit Institutions Act defines e-money as the value of money on an electronic device held by a customer. This could mean eg the value of money in the chip installed in the payment card or the value of money stored in the consumer's home PC. In other words, if the monetary value is stored on the service provider's server, it should perhaps be regarded as account-based money rather than e-money.

#### 3.1.4 Internet payments by credit card

Some international credit cards are accepted globally and can be used also for Internet payments. Because of the growth of fraudulent Internet transactions, card issuers have developed more secure ways of paying via the Internet. The idea is that the consumer need not enter his credit card number or other card details into the Internet as such. In order to increase the security of card payments and customers' confidence in e-commerce, card issuers have developed eg various standards or virtual credit card numbers.

Some credit card institutions have launched special wallet programs; eg the Finnish Visa card issuer Luottokunta has started a digital wallet system called Visa Wallet based on the Secure Electronic Transaction (SET). Before using the wallet program, the customer must have a physical Visa card, install the wallet application into his computer, and register for services. Having done this, he

obtains the virtual card information needed for online purchases. This information is stored in the customer's computer and the cardholder data is never sent via the Internet. However, the SET system has not been used extensively because it has been regarded too complicated. Therefore, Luottokunta has announced that Visa Wallet will be replaced by Verified by Visa. With this solution, Visa and Visa Electron cardholders can pay for purchases via Internet, digital television or mobile phone. Verified by Visa is based on Visa's 3-D Secure Internet security protocol and is simpler and easier to use than Visa Wallet ([www.luottokunta.fi](http://www.luottokunta.fi)).

French Carte Bleue Visa cardholders can also have e-Carte Bleue, a virtual card for paying on the Internet. The idea is that each time a cardholder makes a purchase over the Internet, he receives an e-number to be used instead of the actual card number ([www.e-cartebleue.com](http://www.e-cartebleue.com)). Citibank has also launched this kind of secure online payment technology, called Virtual Account Numbers. When the customer uses the Virtual Account Numbers to make a purchase, a substitute number is generated for every online purchase. So, the customer's actual credit card number is never transmitted on the Internet ([www.citibank.com](http://www.citibank.com)). Furthermore, MasterCard has developed applications for secure virtual payments. One application is Eurocard-MasterCard Virtual Account Programme that provides the customer with a separate personal account number for virtual world use. Besides Internet purchases, it can be used for mobile payments or payments in other remote environments ([www.mastercardeurope.com](http://www.mastercardeurope.com)).

## 3.2 Mobile payment solutions

As stated earlier, mobile phone penetration is very high in Finland. Some mobile-based banking services – eg credit transfers and balance inquiries – have been available in Finland since 1996. At first, mobile banking services were based on SMS text messages, but the latest developments are Wireless Application Protocol (WAP) phone banking applications. WAP phone -based solutions were launched in 1999, and now most Internet banking services offered by banks are also available via WAP. Even before GSM and WAP-based services, there was telebanking in Finland. People can still phone to call centres and handle their banking affairs that way.

Furthermore, there are some new solutions for paying for purchases by mobile phone. The customer is able to have a customer account to which he transfers money from his bank account. Another possibility is to pay for purchases via mobile phone bills or separate bills. In some applications, customers can also make payments by debit or credit card. The mobile phone payment sector is developing rapidly. Below, we discuss only a few of the solutions available at the beginning of 2003.

### 3.2.1 Services based on customer accounts

The Finnish non-bank firm Dynexco has launched a payment solution called DNX MobileMoney whereby a customer has a DNX account to which he is able to transfer funds from his bank account. Having done so, he can pay for purchases of goods or transfer funds to other DNX accounts in real time. At first, paying was based on text messages sent by a GSM phone but, nowadays, it is also possible to pay via Internet. The customer is also able to transfer money from a DNX account back to his bank account. This scheme has been in use since September 2001 ([www.dnxmobiiliraha.com](http://www.dnxmobiiliraha.com)).

Another mobile solution based on a customer account is Sonera Shopper. This service is provided by mobile operator Sonera, which has been active also in the payment area. In this system the customer opens a Shopper account and transfers money to it from his bank account. Thereafter, he can pay for purchases at merchants that have joined the system by sending a text message. The customer can also pay for purchases out of his credit card account (Visa, Eurocard, MasterCard) instead of his Shopper account. In that case the customer's credit card number must be entered into the Shopper system and the customer decides when sending a text message which way he wants to pay. Sonera Shopper has been in pilot use since March 2002 ([www.sonera.fi](http://www.sonera.fi)).

E-Pay sells branded services to merchants. At the moment, these merchants include some restaurants and ski resorts. Also in this solution, the customer first registers for a service and has his own account opened. After that, he can transfer money to this account and pay for purchases and services via mobile phone. Alternatively, purchases can be paid by credit card or direct debit ([www.e-pay.fi](http://www.e-pay.fi)).

With the DNX MobileMoney, Sonera Shopper and E-pay solutions money can be stored on a customer account, and in this sense these services seem to be quite similar to those discussed in section 3.1.2. Each of these three services described here above are provided by non-bank firms.

### 3.2.2 Purchase costs included in the phone bill

Some purchases can also be paid for via a mobile phone in that the costs are included in the customer's monthly mobile phone bill. For instance, services issued by operators, such as purchase of logos or ring tones, are typically invoiced in this way. There are also ca 800 vending machines in Finland, from which the customer can buy eg chocolate bars by calling a premium rate number. The charges for these purchases are included on the mobile bill. One can also pay for parking in some cities in Finland by calling a service number of the parking area. Thereafter, parking is registered and the customer ends the parking by calling again to a nationwide 'ending number'. The parking fee will be included on the

customer's telephone bill, credit card bill or a separate bill, or the customer can pay for parking by Sonera Shopper. This system is called Parkit. Also tickets for tram, underground and Suomenlinna ferry travelling in Helsinki can be paid for by sending a text message to a service number. The customer gets his ticket as a reply text message after ca 30 seconds and can show it to a controller if necessary. These purchases are later included on the mobile phone bill.

### 3.2.3 Dual chip and one chip solutions

Some mobile payment solutions require special features of the mobile phone. For instance, the phone may be a dual chip phone, where one chip is needed for using services provided by the operator and the other for using payment solutions. Technically it is also possible to combine many solutions into one chip card.

The Finnish company Nokia has recently had two mobile payment pilots in cooperation with some other companies. In September 2001 Nokia launched a dual chip solution called EMPS (Electronic Mobile Payment Services). One chip was a usual SIM (subscriber identity module) card and the other was a WIM (WAP identity module) card issued by the Finnish bank Nordea for making Visa Electron payments. The first pilot phase of this scheme ended in March 2002 and the companies have not yet revealed their future plans about this project.

The other project is the Nokia wallet pilot. In this application the phone is equipped with one SWIM chip card that includes both the SIM and WIM functions. In this solution the operator handles customer identification. The credit card number (Visa) is stored inside the phone, and the consumer makes payments by phone and receives a credit card invoice later. This pilot was launched at the beginning of 2002.

### 3.2.4 International mobile payment solutions

In addition to the Finnish mobile phone payment applications, there are many mobile payment solutions in other countries. Also in these solutions customers are able to make transactions eg from bank accounts or customer accounts or by payment card. We discuss just a few of the European examples. As stated earlier, there is a lack of data on mobile payments. However, the statistics may become more comparable in the future.

One of the most widespread mobile phone payment applications is paybox, which was launched in Germany in May 2000. Later it was launched also in Austria, Spain, Sweden and the UK. This service enables the customer eg to purchase goods and services and make bank transactions via mobile phone. The



value of purchases or credit transfers is debited from the customer's bank account ([www.paybox.net](http://www.paybox.net)).

A mobile payment solution called Mobipay is available in Spain. Mobipay can be used eg for payments at real or virtual POS or vending machine. Also person-to-person payments and paying for invoices are possible. While paying, Mobipay activates existing payment means, ie normal or virtual credit, debit or prepaid cards ([www.mobipay.com](http://www.mobipay.com)).

A payment solution called Payex has been launched in Norway. The customer can sign up and open his own Payex account at Payex's website ([www.payex.no](http://www.payex.no)) or he can send a text message. Before using his Payex account, the customer must transfer money into it. Certain purchases can be paid by Payex via Internet. Furthermore, sending money to other people and checking account details can be done via Internet or by sending text messages. In other words, Payex includes both Internet and mobile payment features as do some other schemes discussed earlier in this section.

### 3.3 Some concluding remarks on Internet and mobile payments

As discussed in this section, many Internet- and mobile-based payment solutions are available. However, it may be difficult to categorise these services. In fact, in many cases traditional services are used via new devices. For instance, credit cards and many banking services can be used via Internet and mobile phone in addition to traditional ways. It is possible that services can be used through new channels in the future in order to meet the needs of various customer groups. It is natural that services are provided through many channels in Finland because technological development has been rapid and eg Internet and mobile phone penetrations are high. It is interesting to see which channels will become widely used for using banking or other payment services. For instance, interactive digital TV has recently come on the market in Finland. Also service provision via UMTS phones, PDA and other devices could gain in popularity. In addition to banks, also non-bank firms have started to provide payment services. This is possible in Finland because the amended Credit Institutions Act identifies payment organisations that can provide certain payment services but need not have a banking licence. This Act will be further discussed in section 5.1. The entrance of non-bank service providers into the retail payment area may enhance competition and development in the sector. Overall, competition seems already to be tightening in the payment area and one could say that the retail payment area has become more like business than it was eg ten years ago. Banks have also developed new and cost-effective services in order to increase profitability and

competitiveness and to cut costs. In the next section we discuss some challenges for new retail payment solutions.

## 4 Challenges for new payment solutions

In this paper we have described the development of services in the retail payment area by discussing certain specific payment solutions. Based on the previous sections, it seems that the use of paper-based retail payment instruments is still decreasing and that electronification of retail payments is continuing. New services and service providers have entered the markets. Therefore, it is interesting to consider what it is that causes new services to flourish. What makes consumers use new services or solutions and give up using the older ones?

As stated earlier, pricing is one important factor. If consumers are able to use less expensive substitutes, they are not willing to start using new solutions, unless they provide significant advantages. In Finland banks' pricing policies have clearly been a prime reason behind the wide growth in the use of debit cards and self service such as Internet banking. It is also important that new solutions be easy to use and free of technical problems. Money should also be transferred swiftly, preferably in real time.

A new solution should also provide consumers with better services, ie added value, compared to traditional, well-functioning and widely used substitutes. It is also crucial that new solution be widely accepted. This means that customers need opportunities to use new payment solution. However, the chicken-or-egg problem is typical with new innovations. Merchants are not willing to invest in terminals and so potential customers cannot use the new means of payment. Therefore, costs for merchants, eg investments in infrastructure and commissions for accepting new means of payment, should not be too high. On the other hand, the price of the new solution should be high enough to cover the costs of eg research, development, production and marketing, because service providers cannot make losses for long periods while developing new solutions. It seems to be difficult to reach the critical mass for a new payment solution. Interoperability between various payment solutions could be important in this respect. Standardisation work is currently being done in many forums, by market participants and authorities. However, it may be difficult to develop and agree early enough on standards needed for interoperability. Wide interoperability could also help in developing crossborder retail payments eg in the euro area. The Eurosystem aims at promoting security and efficiency of retail payments. Issues related to these aims, like interoperability and standardisation, have been discussed more deeply in a document published by the ECB (2002).

It is also interesting to consider whether risks related to new payment instruments differ from risks related to more traditional ways of paying. Because new solutions are not widely used nowadays, it is not obvious that they cause systemic risk to the whole financial system. Naturally, if new solutions were used more widely, they could become systemically important. Furthermore, malfunctioning of a new solution could give rise to a reputation risk borne by the developer or provider of the new solution. Moreover, such a malfunctioning may adversely affect public confidence in payment systems in general. Therefore, entities developing and providing new payment solutions should pay adequate attention to inherent risks, for instance, legal and operational risks. Operational risks include eg IT risks, management risks and risks related to criminal activities. New payment solutions are very dependent on technology and so there may be special IT risks. Possible malicious activities also must be taken into account. Attitudes towards risk, ie willingness to take risk, and the sophistication of risk management may vary between different kinds of firms. Risks related to new payment methods would be worth considering more deeply in future studies.

Security, reliability and efficiency are critical features for payment solutions. Security makes consumers more inclined to trust and to use new solutions. Both authorities and market participants strive to raise the security level of new payment instruments. For example, the ECB is drafting security objectives for e-money schemes according to the Common Criteria. Also credit card companies have made security initiatives, as was discussed in section 3.1.4. When making transactions in virtual world many security aspects need to be taken into account. These include eg availability, integrity, authentication, authorisation, non-repudiation and confidentiality (ECB 2002). Technologies based on cryptography have been developed eg for more secure e-payments. The idea of cryptography and Public Key Infrastructure (PKI) are discussed in appendix 3.

## 5 Recent changes in Finnish legislation

Legislation concerning payments also needs to be changed as new solutions are developed. Implementation of related EU directives in Finnish legislation is discussed in this section.

### 5.1 Implementation of directives concerning e-money

Until recently, e-money issuance and provision of certain payment services have not been legislatively regulated in Finland. However, e-money directives 2000/46/EC<sup>16</sup> and 2000/12/EC<sup>17</sup> were implemented in Finland in February 2003 by the revised Credit Institutions Act (69/2003) that provides a regulatory framework for these activities. This Act creates the regulatory framework for a new type of credit institution, the payment organisation, which is entitled to issue e-money and provide payment services. Two other types of credit institutions are deposit banks and credit organisations. The rules pertaining to payment organisations differ to some extent from those for the other two. For instance, a payment organisation cannot grant any type of credit and is subject to strict limits on risk taking. Furthermore, supervision of a payment organisation differs somewhat from that of other credit institutions.

The Credit Institutions Act clarifies the supervision of new payment solutions and service providers in Finland. This Act is discussed further in Kauko (2002).

### 5.2 Implementation of the electronic commerce directive

The e-commerce directive<sup>18</sup> was implemented in Finland in July 2002 by the Act on the provision of information society services<sup>19</sup> (458/2002). The directive seeks to improve the internal market by creating a legal framework to ensure the free movement of information society services between Member States. Information society services are electronic remote services that are delivered on customer request. The law provides that service providers be supervised according to the

---

<sup>16</sup> Directive 2000/46/EC of the European Parliament and of the Council on the taking up, pursuit of and prudential supervision of the business of electronic money institutions.

<sup>17</sup> Directive 2000/12/EC of the European Parliament and of the Council relating to taking up and pursuit of the business of credit institutions.

<sup>18</sup> Directive 2000/31/EC of the European Parliament and of the Council on certain legal aspects of information society services, in particular electronic commerce, in the Internal Market (Directive on electronic commerce).

<sup>19</sup> Unofficial translation of the name of the Act.

country of origin principle. In other words, these companies are to be supervised on the basis of their respective home-country legislation even if they provide services abroad. Furthermore, certain information on service providers and their activities must at all times be readily available to customers and authorities. The law also includes eg details on electronic contracts.

### 5.3 Implementation of the directive on electronic signatures

The directive on electronic signatures<sup>20</sup> was included into the Act on electronic signatures<sup>21</sup> (14/2003) that came into force in February 2003. The purpose of the law is to facilitate the use of electronic signatures and their legal recognition. The law contributes to the public trust as regards e-commerce and promotes the development of security services.

The law includes the definition of advanced electronic signature and quality certificate. Advanced electronic signature is judicially equal to the handwritten signature. The quality certificate provider has some responsibilities, eg confidential recognition of a customer and the use of secure systems. The law defines also the minimum requirements for the content of the quality certificate and the responsibility for faulty certificates. According to the directive, each Member State has to establish a supervisory system to control the Certification Service Providers (CPS). In Finland this authority is the Finnish Communications Regulatory Authority (FICORA).

---

<sup>20</sup> Directive 1999/93/EC of the European Parliament and of the Council on a Community framework for electronic signatures.

<sup>21</sup> Unofficial translation of the name of the Act.

## 6 Summary

Electronification seems to be the trend of development for retail payments. The use of paper-based retail payment instruments is decreasing as new payment instruments come into existence. In addition to traditional bank-based services, new service providers have begun to develop and provide new payment tools and services for consumers. For instance, telecom operators have recently been quite active in the retail payments sector. Competition and new technology enable new solutions. For the time being, there are many payment solutions that can be used eg via Internet or mobile phone. It is possible that some of these services will become widely used, even internationally. As overseer, the Bank of Finland is interested in efficiency and reliability of payment systems.

In this paper we have concentrated on describing recent trends in card, Internet and mobile payments, mainly in Finland, and have also made some international comparisons. In section 1 we discussed some reasons behind the high level of electronification in Finland. For instance, debit cards have long been a very popular payment method. One reason for this is that banks started to charge for the use of cheques in 1988 and, at the same time, were issuing debit cards to customers free of transaction-based charge. In section 2 we looked at various payment cards in Finland and classified cards based on their features. The absolute number and value of card payments were ca six-fold in 2001 compared to 1986. We also made some comparisons regarding payment cards between Finland and some other countries. International comparison of card payments shows that the growth of card usage has been much more rapid in many countries compared to Finland and some countries have also reached relatively higher level of card usage. In section 3 we discussed some Internet- and mobile-based payment modes. As seen, it is not very simple to classify payments as Internet or mobile payments and, in the future, the classification may be even more difficult as retail payment solutions continue developing. The penetration of Internet and mobile phones is high in Finland and thus it is natural to develop new services based on these devices. On the other hand, traditional services are available via new channels. For instance, customers can use basic banking services via Internet, mobile phone and interactive digital TV. It is also interesting to consider why consumers do, or do not, begin to use new payment solutions in their daily transactions. Some considerations concerning the new challenges were discussed in section 4. Finally, legislation related to making payments needs to be developed as new solutions arrive. Implementation of some of the relevant EU directives in Finnish legislation was discussed section 5.

To recap, many payment solutions have come into existence and there is a demand for various payment solutions because the consumers' needs are varied.

However, it is difficult to say which solutions will survive and which will flourish at the national or international level.

## References

- Bank of Finland (1993) **Payment and Settlement Systems in Finland**. Bank of Finland publications A:88, 1993.
- Bank for International Settlements (1995) **Statistics on payment systems in the group of ten countries**.
- Bank for International Settlements (2001) **Survey of electronic money developments**.
- Bank for International Settlements (2001b) **Statistics on payment systems in the group of ten countries**.
- Bank for International Settlements (2002) **Statistics on payment and settlement systems in selected countries**.
- Chakravorti, S. – McHugh, T. (2002) **Why do we use so many checks?** Economic Perspectives, 3Q/2002.
- Committee of Governors of the central banks of the Member States of the European Economic Community (1992) **Payment systems in EC member states**.
- European Monetary Institute (1996) **Payment systems in the European Union**.
- European Central Bank (1998) **Report on electronic money**.
- European Monetary Institute (1998) **Payment systems in the European Union (Blue Book)**.
- European Central Bank (2001) **Payment and securities settlement systems in the European Union (Blue Book)**.
- European Central Bank (2002) **E-Payments in Europe – The Eurosystem's Perspective**. Issues Paper.
- European Central Bank (2002b) **Payment and securities settlement systems in the European Union (Blue Book)**.
- Finnish Bankers' Association (1989) **Maksujärjestelmät ja pankkien jakeluverkot**.



- Finnish Bankers' Association (1992) **Maksujärjestelmät ja pankkien jakeluverkot vuosina 1987–1991.**
- Finnish Bankers' Association (2002) **Tilastotietoja pankkien maksujärjestelmistä Suomessa 1992–2001.**
- Hatakka, T. (1997) **Maksujärjestelmät ja -välineet EU:ssa. Vertailu Suomen ja eräiden EU-maiden välillä.** Suomen Pankin keskustelualoitteita 19/1997.
- McHugh, T. (2002) **The growth of person-to-person electronic payments.** Chicago Fed Letter, Federal Reserve Bank of Chicago, August 2002, No. 180.
- International Monetary Fund (2001) **International Financial Statistics.**
- Kauko, K. (2002) **New legislation to diversify financial services.** Bank of Finland Bulletin 4/2002.
- Koskenkylä, H. (ed.) (2002) **Suomen rahoitusmarkkinat 2002.** Suomen Pankin tutkimuksia A:102, 2002. Forthcoming in English in 2003.
- Leinonen, H. (2003) **Développement de la banque en ligne dans les pays nordiques.** Revue d'économie financière 1/2003 (forthcoming).
- Mooslechner, P. – Stix, H. – Wagner, K. (2002) **The Payment Habits of Austrian Households – Results of a Study on the Use of Payment Cards and the Structure of Payment Transactions in 2000.** Focus on Austria, 1/2002. Oesterreichische Nationalbank.
- OECD (2002) **ICTs and the Information Economy.** Information Technology Outlook.
- Saarinen, V. (1996) **Maksujärjestelmät ja -välineet Suomessa.** Suomen Pankin keskustelualoitteita 17/1996.
- Snellman, J. (1999) **Digitaalinen allekirjoitus.** Suomen Pankin rahoitusmarkkinaosaston työpaperi 4/1999.
- Snellman, J. (2000) **Evolution of Retail Payments in Finland in the 1990s.** Bank of Finland Discussion Paper 19/2000.
- Statistics Finland (2002) **Luottokortit 2001.**

## Web pages

<a href="http://europa.eu.int/eur-lex">europa.eu.int/eur-lex</a>	EUR-Lex: European Union law
<a href="http://www.avant.fi">www.avant.fi</a>	Avant
<a href="http://www.citibank.com">www.citibank.com</a>	Citibank
<a href="http://www.digiraha.net">www.digiraha.net</a>	Digiraha
<a href="http://www.dnsmobiiliraha.com">www.dnsmobiiliraha.com</a>	DNX Mobiiliraha
<a href="http://www.e-cartebleue.com">www.e-cartebleue.com</a>	e-Carte Bleue
<a href="http://www.ecb.int">www.ecb.int</a>	European Central Bank
<a href="http://www.e-pay.fi">www.e-pay.fi</a>	e-Pay
<a href="http://www.ficora.fi">www.ficora.fi</a>	Finnish Communications Regulatory Authority
<a href="http://www.finlex.fi">www.finlex.fi</a>	FINLEX
<a href="http://www.luottokunta.fi">www.luottokunta.fi</a>	Luottokunta
<a href="http://www.mastercardeurope.com">www.mastercardeurope.com</a>	MasterCard Europe
<a href="http://www.mintc.fi">www.mintc.fi</a>	Ministry of Transport and Communications Finland
<a href="http://www.mobipay.com">www.mobipay.com</a>	Mobipay
<a href="http://www.nordea.fi">www.nordea.fi</a>	Nordea
<a href="http://www.omnipay.190.it">www.omnipay.190.it</a>	Omnipay
<a href="http://www.osuuspankki.fi">www.osuuspankki.fi</a>	OKO Bank
<a href="http://www.pankkiyhdistys.fi">www.pankkiyhdistys.fi</a>	The Finnish Bankers' Association
<a href="http://www.paybox.net">www.paybox.net</a>	paybox
<a href="http://www.payex.no">www.payex.no</a>	Payex
<a href="http://www.paypal.com">www.paypal.com</a>	Paypal
<a href="http://www.pkiforum.org">www.pkiforum.org</a>	OASIS PKI Member Section
<a href="http://www.pyha.fi">www.pyha.fi</a>	Pyhä
<a href="http://www.ruka.fi">www.ruka.fi</a>	Ruka
<a href="http://www.sampo.fi">www.sampo.fi</a>	Sampo
<a href="http://www.sonera.fi">www.sonera.fi</a>	Sonera
<a href="http://www.unicard.fi">www.unicard.fi</a>	Unicard
<a href="http://www.vaestorekisterikeskus.fi">www.vaestorekisterikeskus.fi</a>	Population Register Centre

# Appendix 1

Table A1.1

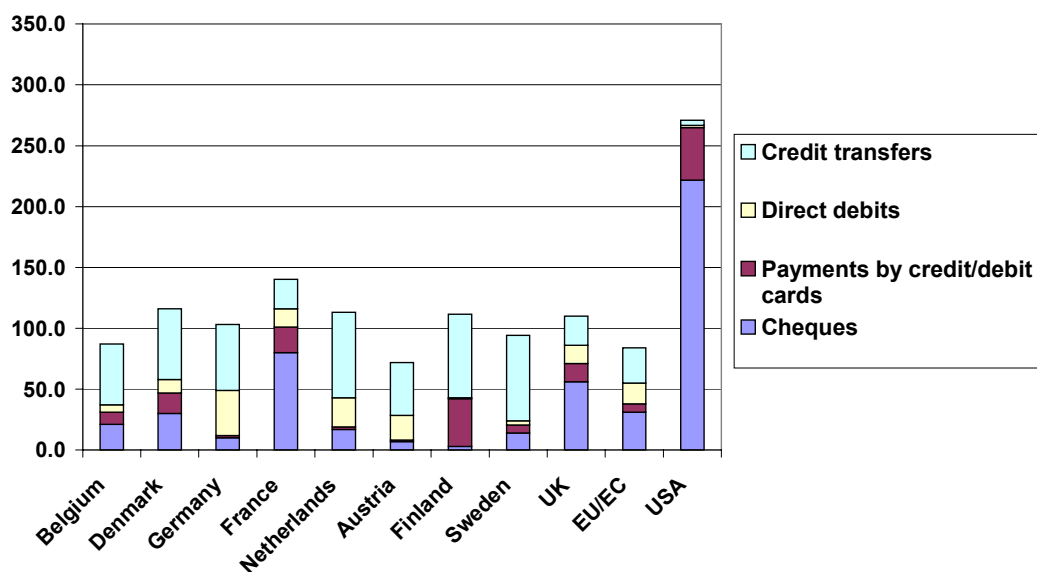
## Use of cashless payment instruments (number of transactions per inhabitant)

	Cheques		Payments by credit/debit cards		Direct debits		Credit transfers		Card-based e-money		Total	
	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000
Belgium	21.0	7.0	10.0	45.0	6.0	16.0	50.0	64.0	#N/A	5.0	87	137
Denmark	30.0	10.0	17.0	79.0	11.0	24.0	58.0	40.0	#N/A	1.5	116	156
Germany	10.0	5.0	2.0	15.0	37.0	67.0	54.0	87.0	#N/A	0.3	103	177
France	80.0	74.0	21.0	54.0	15.0	33.0	24.0	35.0	#N/A	#N/A	140	196
Netherlands	17.0	1.0	2.0	54.0	24.0	53.0	70.0	72.0	#N/A	#N/A	113	179
Austria	7.0	1.0	1.2	14.0	20.2	33.0	43.3	61.0	#N/A	0.4	72	110
Finland	2.8	0.2	39.4	71.0	0.8	8.0	68.6	105.9	#N/A	0.1	112	185
Sweden	14.0	0.2	6.4	36.0	3.5	10.0	70.3	81.0	#N/A	0.3	94	127
UK	56.0	45.0	15.0	63.0	15.0	34.0	24.0	31.0	#N/A	#N/A	110	173
EU/EC	31.0	24.0	7.0	33.0	17.0	35.0	29.0	42.0	#N/A	0.6	84	135
USA	221.7	180.1	43.0	109.1	1.9	7.1	4.2	12.7	#N/A	#N/A	271	309

Source: ECB, EMI and BIS

Figure A1.1

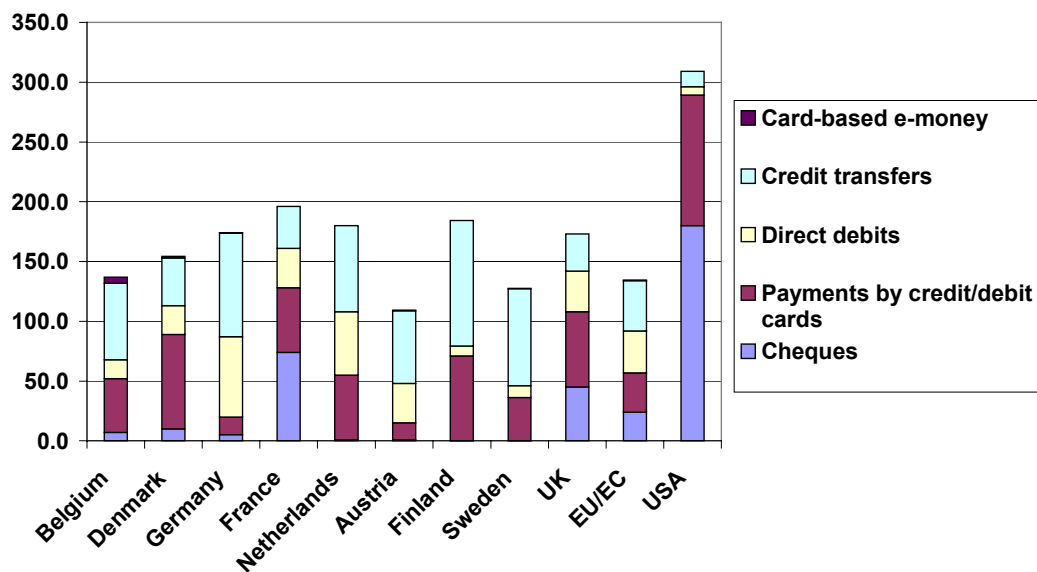
## Use of cashless payment instruments, 1990 (number of transactions per inhabitant)



Source: ECB, EMI and BIS

Figure A1.2

**Use of cashless payment instruments, 2000  
(number of transactions per inhabitant)**



Source: ECB, EMI and BIS

Table A1.2

**Relative importance of cashless payment  
instruments  
(% of total number of cashless transactions)**

	Cheques		Payments by credit/debit cards		Direct debits		Credit transfers		Card-based e-money	
	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000
Belgium	24.0	5.0	11.0	32.8	7.0	11.8	58.0	46.7	#N/A	3.6
Denmark	26.0	6.7	14.0	51.1	10.0	15.6	50.0	25.7	#N/A	1.0
Germany	10.0	3.0	1.0	9.6	36.0	38.1	53.0	49.1	#N/A	0.2
France	56.0	37.9	15.0	27.8	10.0	16.6	17.0	17.7	#N/A	#N/A
Netherlands	15.0	0.5	2.0	29.9	21.0	29.1	62.0	39.7	#N/A	#N/A
Austria	9.8	1.3	1.6	12.5	28.0	30.0	60.2	55.8	#N/A	0.3
Finland	2.5	0.1	35.2	38.7	0.7	4.5	61.3	56.6	#N/A	0.1
Sweden	14.9	0.2	6.8	28.3	3.7	8.0	74.8	63.2	#N/A	0.3
UK	51.0	26.1	14.0	36.6	13.0	19.4	22.0	17.9	#N/A	#N/A
EU/EC	37.0	16.9	9.0	26.5	20.0	24.9	34.0	33.1	#N/A	0.4
USA	81.9	58.3	15.9	35.3	0.7	2.3	1.3	4.1	#N/A	#N/A

Source: ECB, EMI and BIS

## Appendix 2

Table A2.1 **Number of card payments, millions**

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Belgium	96	119	145	169	191	218	248	280	341	402	462
Denmark	85	116	147	178	214	248	288	321	359	393	424
Germany	122	170	214	294	351	416	504	529	993	1198	1389
France	1178	1328	1443	1565	1672	1889	2103	2334	2621	2912	3292
Netherlands	27	32	47	92	193	256	415	534	644	753	859
Austria	9	11	14	17	20	26	34	49	65	87	112
Finland	196	212	218	212	229	244	263	272	297	324	370
Sweden	55	68	62	68	85	101	132	169	213	255	320
UK	855	1049	1237	1397	1606	1912	2296	2631	2960	3406	3789
USA	10756	11542	12205	13188	14728	16513	18599	20791	23255	26334	30035

Table A2.2 **Annual changes in the number of card payments**

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	1990–2000
Belgium	25 %	21 %	17 %	13 %	14 %	14 %	13 %	22 %	18 %	15 %	384 %
Denmark	36 %	27 %	21 %	20 %	16 %	16 %	11 %	12 %	9 %	8 %	399 %
Germany	40 %	26 %	37 %	19 %	19 %	21 %	5 %	88 %	21 %	16 %	1041 %
France	13 %	9 %	8 %	7 %	13 %	11 %	11 %	12 %	11 %	13 %	179 %
Netherlands	19 %	46 %	97 %	110 %	33 %	62 %	29 %	21 %	17 %	14 %	3080 %
Austria	22 %	27 %	21 %	18 %	29 %	33 %	44 %	32 %	33 %	29 %	1140 %
Finland	8 %	3 %	-3 %	8 %	6 %	8 %	3 %	9 %	9 %	14 %	88 %
Sweden	24 %	-9 %	10 %	25 %	19 %	31 %	28 %	26 %	20 %	25 %	482 %
UK	23 %	18 %	13 %	15 %	19 %	20 %	15 %	13 %	15 %	11 %	343 %
USA	7 %	6 %	8 %	12 %	12 %	13 %	12 %	12 %	13 %	14 %	179 %

Table A2.3 **Value of card payments, billions**

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Belgium, BEF	205	262	331	388	443	463	576	676	806	922	1063
Denmark, DKK	41	53	57	60	76	87	105	117	132	145	156
Germany, DEM	23	30	36	48	57	63	89	92	158	188	214
France, FRF	380	437	475	511	661	600	656	714	713	886	1004
Netherlands, NLG	1	2	4	10	22	23	43	57	67	82	95
Austria, ATS	13	15	18	23	25	30	43	53	66	87	111
Finland, FIM	47	49	50	50	54	57	61	71	78	83	95
Sweden, SEK	34	43	44	53	64	86	101	124	149	174	208
UK, GBP	33	39	45	51	60	71	87	103	118	141	163
USA, USD	479	501	551	650	776	938	1083	1234	1396	1613	1882

Table A2.4 **Annual changes in the value of card payments**

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	1990–2000
Belgium	28 %	26 %	17 %	14 %	4 %	24 %	17 %	19 %	14 %	15 %	419 %
Denmark	29 %	8 %	5 %	27 %	14 %	21 %	11 %	13 %	10 %	8 %	280 %
Germany	33 %	19 %	35 %	18 %	10 %	42 %	3 %	71 %	19 %	14 %	848 %
France	15 %	9 %	8 %	29 %	-9 %	9 %	9 %	0 %	24 %	13 %	164 %
Netherlands	54 %	90 %	163 %	116 %	7 %	85 %	34 %	16 %	22 %	16 %	7189 %
Austria	15 %	20 %	28 %	9 %	21 %	43 %	23 %	25 %	30 %	28 %	753 %
Finland	4 %	2 %	-1 %	9 %	6 %	8 %	15 %	10 %	7 %	14 %	101 %
Sweden	26 %	2 %	20 %	21 %	34 %	17 %	23 %	20 %	17 %	20 %	512 %
UK	19 %	16 %	14 %	16 %	19 %	23 %	18 %	15 %	19 %	16 %	397 %
USA	5 %	10 %	18 %	19 %	21 %	15 %	14 %	13 %	16 %	17 %	293 %

## Appendix 3

Cryptography technologies used for secure e-payments can in principle be divided into symmetric and asymmetric encrypting. Symmetric encrypting means that a secret key is used for both encrypting and decrypting. In other words, both communicating parties have the same secret key, ie symmetric encryption is bilateral. Perhaps the main challenge of symmetric encryption relates to the secure exchange and storage of secret keys. Key management is decentralised, ie each counterparty is responsible for the secret keys it needs to communicate with other counterparties.

Asymmetric encryption, ie Public Key Cryptography (PKC), means that encryption and decryption are done using different keys. The customer has a private key that is used for encryption. A public key that is used for decryption is available to all interested parties. To assure that the information has not been manipulated during the sending process, the customer can use a digital signature<sup>22</sup>. Because public keys should be available to many counterparties, key management need to be centralised. Public Key Infrastructure (PKI) consists of PKC and the infrastructure needed for key management and other critical functions. Infrastructure includes Register Authority (RA), Certificate Authority (CA) and Directory Services. One institution may have more than one of these functions. RA identifies the customer for the first time, ie ascertains that the customer is who he claims to be. CA issues the key pair, revokes keys and publishes lists of revoked keys. In other words, CA reliably links the customer to his public key, ie provides certification. If there are many CAs in the PKI, the level of trustworthiness of CAs may vary. A CA that is higher in the trust hierarchy than other CAs proves the identity of CAs that are lower in the hierarchy. The root CA is the CA at the top of the hierarchy. Directory Services are databases for storing public keys and lists of certificates. Additional information about PKI and related topics are available eg at [www.pkiforum.org](http://www.pkiforum.org) and [www.ficora.fi](http://www.ficora.fi) (Finnish Communications Regulatory Authority).

For the time being, there are some solutions based on PKI technology in Finland. However, many of these are in a pilot phase and their usage is quite limited. One example of a Finnish PKI-based solution is the EID (electronic identification) card<sup>23</sup> provided by the Population Register Centre ([www.vaestorekisterikeskus.fi](http://www.vaestorekisterikeskus.fi)). This card can be used for identifying customers

---

<sup>22</sup> Digital signature here means only signatures created by using PKC. Electronic signatures refers to the possibilities for expressing a signature electronically, eg scanning hand-written signature. The idea of digital signature is presented eg in Snellman (1999).

<sup>23</sup> EID card is called HST card in Finland.

for certain online services provided by the government or private firms<sup>24</sup>. To be able to use his card, a customer needs a card reader. At the end of 2002, there were ca 13,000 EID cards in circulation. The EID card is not yet widely used because the number of services available is very limited. In the future, card usage will be possible also via mobile phones.

Several PKI schemes have come into existence. We could ask what is the optimal number of PKI schemes providing security services. For instance, in case of many PKI schemes their reliability may differ and malfunctions in one scheme could adversely affect public confidence in other PKI schemes. Furthermore, in case of non-interoperable schemes, customers may need to have multiple certificates for different purposes (eg for banking services, authority services, mobile phone payments, etc). On the other hand, the existence of many PKI schemes would mean more competition, which would increase efficiency and choice for customers. Thus an appropriate balance should be found in this respect.

In conclusion, the use of PKI-based payment solutions is at a low level in Finland. For the time being, there does not exist any widely-used PKI-based solution in the payment sector. PKI may be regarded as a complicated and costly solution, which has induced banks to use their own solutions for identifying customers. PKI and legal, technical and interoperability considerations related to it are discussed in detail in an ECB document (2002).

---

<sup>24</sup> For instance, customers of OKO Bank can identify themselves by EID card when using Internet banking services. OKO Bank customers will be able to combine an EID card with a debit card in 2003.

## **BANK OF FINLAND DISCUSSION PAPERS**

ISSN 0785-3572, print; ISSN 1456-6184, online

- 1/2003 Tanai Khiaonarong **Payment systems efficiency, policy approaches, and the role of the central bank.** 2003. 69 p. ISBN 952-462-025-1, print; ISBN 952-462-026-X, online. (TU)
- 2/2003 Iftekhhar Hasan – Heiko Schmiedel **Do networks in the stock exchange industry pay off? European evidence.** 2003. 44 p. ISBN 952-462-027-8, print; ISBN 952-462-028-6, online. (TU)
- 3/2003 Johanna Lukkarila **Comparison between Asian, Russian and Turkish financial crises.** (In finnish). 2003. 57 p. ISBN 952-462-029-4, print; ISBN 952-462-030-8, online. (KT)
- 4/2003 Samu Peura – Esa Jokivuolle **Simulation-based stress testing of banks' regulatory capital adequacy.** 2003. 41 p. ISBN 952-462-035-9, print; ISBN 952-462-036-7, online. (RM)
- 5/2003 Peik Granlund **Economic evaluation of bank exit regimes in US, EU and Japanese financial centres.** 2003. 60 p. ISBN 952-462-037-5, print; ISBN 952-462-038-3, online. (TU)
- 6/2003 Tuomas Takalo – Otto Toivanen **Equilibrium in financial markets with adverse selection.** 2003. 45 p. ISBN 952-462-039-1, print; ISBN 952-462-040-5, online (TU)
- 7/2003 Harry Leinonen **Restructuring securities systems processing – a blue print proposal for real-time/t+0 processing.** 2003. 90 p. ISBN 952-462-041-3, print; ISBN 952-462-042-1, online (TU)
- 8/2003 Hanna Jyrkönen – Heli Paunonen **Card, Internet and mobile payments in Finland.** 2003. 45 p. ISBN 952-462-043-X, print; ISBN 952-462-044-8, online (RM)