

**Payment systems in
Switzerland**

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List of abbreviations

CLS	continuous linked settlement
DTA	<i>Datenträgeraustausch</i> (data media exchange facility)
EBPP	electronic bill presentment and payment
FBC	Federal Banking Commission
LSV	<i>Lastschriftverfahren</i> (direct debit facility)
SECB	Swiss Euro Clearing Bank
SET	Secure Electronic Transaction
SIC	Swiss Interbank Clearing
SIS	SIS SegalInterSettle AG (formerly SEGA AG)
SNB	Swiss National Bank
SWX	Swiss Stock Exchange

Introduction

The Swiss trading, settlement and payment infrastructure consists of various interlinked electronic systems. Swiss Interbank Clearing (SIC) is the real-time gross settlement (RTGS) system designed for settling interbank payments in Swiss francs in accounts at the Swiss National Bank (SNB). SIC is operated by Swiss Interbank Clearing AG, a subsidiary of Telekurs Holding, which is a private sector company involved in payment activities. In 1995 a link between SIC and SECOM, the securities settlement system operated by SIS SegalInterSettle AG (formerly SEGA), was established to allow simultaneous and final delivery versus payment on a real-time basis. In 1996, a connection with the Swiss Stock Exchange (SWX) was established. This connection allows straight through processing of securities operations (eg from trading to settlement). Swiss Interbank Clearing AG also operates retail payment systems such as DTA (data media exchange) and LSV (direct debit). Postfinance provides similar payment services through its own network.

Over the last few years, two major trends have affected the trading, settlement and payment infrastructure in Switzerland. First, the growing internationalisation of trading, settlement and payment activities has led to cross-border network connections. At the trading level, SOFFEX (Swiss Options and Financial Futures Exchange, a former subsidiary of SWX) and Deutsche Terminbörse (DTB) merged in 1996 to create Eurex, the Swiss-German derivatives exchange. In 2001, SWX, the UK-based Tradepoint Exchange and Tradepoint Consortium launched virt-x, a pan-European trading platform for blue chips of all major European indices. At the securities settlement level, SIS SegalInterSettle and CRESTCo created The Settlement Network in 2000. At the payment system level, this trend made it necessary to allow financial institutions located outside Switzerland to participate in SIC (so-called remote members). Second, the various retail payment systems have been progressively integrated into SIC. In this way, the aggregate gross positions resulting from these systems are settled in SIC. This process started in 1998 with the integration of DTA and LSV and was completed with the integration of cheque settlement in 2000.

In addition, some innovations have been introduced in SIC. Intraday credit in the form of intraday repos was made available to SIC participants in 1999. Further, Postfinance has been participating in SIC since 2000. This has simplified payment flows between the bank and Postfinance systems. Lastly, in 2001, the SIC queuing mechanism was amended with a bilateral offsetting mechanism aimed at solving gridlocks. At the regulatory level, the new Law on the SNB, which is expected to be enacted in 2004, will create a formal basis for the SNB's oversight responsibilities in clearing, settlement and payment systems.

1. Institutional aspects

1.1 The general framework

Cashless transfers on behalf of customers are executed in Switzerland by commercial banks and the state-owned Postfinance. Rules governing banking operations are contained in the Federal Law on Banks and Savings Banks, those governing the activity of Postfinance in the Postal Service Law.

Under Swiss law, no comprehensive and uniform set of rules governing payment systems has been enacted. Rather, the legal framework for the operation of these systems consists of contractual arrangements among the various participants, including general contract terms and technical regulations. These contracts are based on the general principles of the Civil Code and the Code of Obligations.

1.2 The role of the Swiss National Bank

1.2.1 Oversight of payment systems

Article 99 of the Federal Constitution of the Swiss Confederation concerns monetary policy. It entitles the Swiss National Bank (SNB), as an independent central bank, to pursue a monetary policy that serves the general interest. At a more concrete level, the tasks of the SNB are defined in Article 2 of

the Law on the SNB. The SNB has “to regulate the country’s money circulation, to *facilitate payment transactions* and to pursue a credit and monetary policy that serves the interests of the country as a whole”.

The current Law on the SNB is fairly vague about the role of the central bank as overseer of payment systems. With respect to Swiss Interbank Clearing (SIC), the RTGS system in Switzerland, two private law contracts enable the SNB to exercise its oversight responsibility. The first contract is between the SNB and SIC AG, the system operator. The second contract governs the relationship between the SNB and the participants.

The Law on the SNB, however, is currently under revision. The new Law, which is scheduled to become effective in 2004, creates a formal basis for the SNB to oversee not only payment systems, but also securities clearing and settlement systems.¹ Oversight activities will be conducted according to a three-stage procedure. The first stage requires all system operators to provide the SNB with basic statistical information. The second step allows the SNB to gain more precise information on systems that are potentially of systemic importance. The third stage deals with systemically important payment and settlement systems. These systems may be subject to specific requirements and sanctions, if necessary.

1.2.2 Banking activities

The SNB acts as the Confederation’s bank. It takes care of some of the Federal Government’s domestic and foreign payments (via giro accounts), the collection of commercial bills and cheques and the administration of securities and valuables. In addition, it cooperates in the investment of Federal funds and the issuing of Federal bonds.

The automatic financing of federal budget deficits by means of central bank credits is precluded by law. Cooperation in the investment of Federal funds - which is governed by an agreement between the Federal Finance Administration and the SNB - is of particular interest to the SNB because the way in which the Government manages its current resources influences the liquidity of the money market. The SNB’s cooperation in the issuing of bonds, treasury bonds and money market claims is of a technical and advisory nature. The SNB also acts as a payment office for coupons and repayments of government bonds.

1.2.3 Provision of cash settlement facilities

(a) Provision of giro (or reserve) accounts

Article 14 of the Law on the SNB empowers the central bank to operate giro (or reserve) accounts and carry out giro and clearing transactions. The SNB operates giro accounts for banks, public entities, foreign central and commercial banks and international organisations. At the end of 2000 there were 588 accounts. Giro account balances are non-interest bearing sight liabilities of the SNB. Giro accounts are maintained free of charge. The SNB’s giro system is used above all for the processing of payment instructions from banks which are not participants in SIC, and for cash inpayments to and withdrawals from the SNB. Orders are voucher-based.

Members of the SIC system must have a giro account at the SNB. It is split into an SIC account and the traditional giro account which, in the payment system context, is called the “master account”.

(b) Provision of credit facilities

In implementing monetary policy, the SNB usually enters repo transactions at 9 am every working day. It also provides intraday and overnight credit facilities. The intraday credit facility - in the form of intraday repos - aims at facilitating settlement in SIC. There is no interest charge on intraday repos. Banks can obtain intraday credit from the beginning of the settlement day (around 5.30 pm). After 8 am intraday credit is available at any time up until 2.45 pm. If the participant has enough collateral, the funds are transferred within seconds of the request being made. Repayment of the intraday credit

¹ In the area of securities clearing and settlement systems, the SNB and the Federal Banking Commission (FBC), the banking supervisory authority, will cooperate closely.

can be made at any time during business hours. If it is not repaid by the end of the day (clearing stop 3 at 4.15 pm), an interest charge that exceeds the overnight rate by (currently) 400 basis points applies.

The overnight credit facility - the lombard facility - offers financial institutions facing an unexpected liquidity shortage a refinancing source. Financial institutions draw on lombard credits on their own initiative and at any time of the day (in practice, mostly towards the end of the day). They freely set their credit limit at the SNB by pre-pledging eligible securities. Credit lines can be adjusted once a year. For lombard loans, the SNB charges a rate that exceeds the overnight rate by 200 basis points (lombard rate).

1.3 The role of other private and public institutions

1.3.1 Banks

At the end of 2000 there were 335 banks in Switzerland with a total of 2,849 branches subject to the Swiss Banking Law. These include 23 branches of foreign banks with 27 offices. Most of the banks are universal banks, which offer their customers a full range of banking services. However, a number of banks are specialised: private banks, for instance, are engaged almost exclusively in investment management, while other categories of banks (the regional and savings banks) are concerned predominantly with mortgage business. In addition to the usual payment services such as inpayment, outpayment and credit and debit transfers, the banks also offer credit, debit and stored value cards.

In 1949 the big banks founded their own giro organisation, the "Bank Clearing" organisation. Over the next few years the cantonal banks, the regional banks and most other institutions also joined this system. In 1981 responsibility for the administrative and technical operation of the system was assigned to Telekurs Payserv Ltd (today's Swiss Interbank Clearing AG), a joint venture of the Swiss banks. The regional banks have been operating their own giro system since 1981, since which time they have been participating indirectly in Bank Clearing via their clearing centre. In 1994, the regional banks formed a new holding company, RBA-Holding. The previous clearing centre was fully integrated into this new company in 1996.

1.3.2 Postfinance

As early as 1906, a year before the SNB was founded, the Postal Administration received authorisation to open accounts for any firm or private individual; transactions such as cashless transfers, inpayments and outpayments could be carried out through these post office accounts. The Postal Administration's network of post offices throughout Switzerland provided the necessary infrastructure. In order to tell the two postal services - mail and banking business - apart, the former is called "Die Post" (Swiss Post) and the latter is called "Postfinance". In 2000 Postfinance had a network of 3,385 post offices. With over 2.2 million accounts and 737 million transactions a year, Postfinance plays a major role in the field of retail payments. The banks also execute some of their customers' payment orders via Postfinance. Since 2000 payments between bank and Postfinance networks have been settled in SIC.

1.3.3 Credit card companies

Credit cards have become exceedingly popular in recent years. MasterCard/Eurocard, Visa, American Express and Diners Club cards predominate on the Swiss market. Acquiring is handled by Europay (Switzerland) SA and also by some banks directly. Since 2001, the banks have handled the issuing of credit cards. Settlement occurs at the banks' processing centres or at Payserv Ltd. In addition, other companies such as Postfinance and the Federal Railways appear as brand names on credit cards. Petrol companies and large retailers also issue credit cards for use in their own outlets only.

1.3.4 Telekurs Holding Ltd

Telekurs Holding Ltd is a service organisation owned by Swiss banks. It provides services in the fields of payment systems and financial information. Swiss Interbank Clearing AG, a subsidiary of Telekurs Holding, is the operator of the SIC system. Other subsidiaries involved in payment systems are Payserv Ltd and Europay (Switzerland) SA. Payserv Ltd is active in payment instruments and systems, while Europay (Switzerland) SA is committed to promoting cashless payment instruments.

1.3.5 FSG Swiss Financial Services Group

Like Telekurs Holding, the FSG Swiss Financial Services Group is owned by the Swiss banking community. The most important subsidiary of the FSG Group with regard to the Swiss market infrastructure is SIS SegalInterSettle AG (SIS). SIS undertakes the central custody of securities and the settlement of securities transactions through its SECOM platform.

1.3.6 SWX Swiss Exchange

The SWX Swiss Exchange (SWX) was created in 1995 through the merger of three regional exchanges (Basel, Geneva and Zurich). It is registered as an association within the context of Article 60 of the Swiss Civil Code. It is a non-profit organisation. SWX operations are governed by the Swiss Federal Act on Stock Exchanges and Securities Trading, which also provides the legal basis for self-regulation. It is licensed and supervised by the Federal Banking Commission.

1.3.7 Eurex

The Swiss-German derivatives exchange Eurex was created by SWX and Deutsche Börse AG in December 1996 through the merger of SOFFEX (Swiss Options and Financial Futures Exchange, a former subsidiary of SWX) and DTB Deutsche Terminbörse. Eurex Clearing AG is wholly owned by Eurex Frankfurt AG, which in turn is a subsidiary (100%) of Eurex Zurich. The latter is jointly owned by Deutsche Börse AG and SWX.

2. Payment media used by non-banks

2.1 Cash payments

The exclusive right to issue banknotes is conferred on the SNB by the Federal Constitution. This includes periodically developing new series of banknotes as well as the production, distribution and withdrawal of banknotes; old and unusable banknotes are destroyed and replaced by new ones. Banknotes are produced by a private sector company; issue and withdrawal is carried out by the SNB via its offices in Zurich, Berne, Geneva and Lugano and 18 agencies operated by cantonal banks. Coins are struck by the Federal Mint in Berne. The distribution and withdrawal of coins throughout the country is carried out by the SNB. Notes are issued in six denominations (CHF 10, 20, 50, 100, 200 and 1,000) and coins in eight denominations (CHF 0.01, 0.05, 0.10, 0.20, 0.50, 1, 2 and 5).

In Switzerland cash continues to be the most widely used payment medium in retail business. Cash withdrawals are made mainly at cash dispensers or over the counter at banks and post offices. In 2000 currency in circulation - including cash in bank vaults - amounted to CHF 37.8 billion. Notes and coins are legal tender.²

2.2 Non-cash payments

2.2.1 Sight deposits

Firms and individuals use sight deposits at banks and Postfinance to make cashless payments. In 2000 sight deposits amounted to CHF 97 billion. Currently, the banks pay interest of approximately 0.25% on current accounts and of around 0.5% on salary and personal accounts; Postfinance pays 0.5% interest on personal account balances of up to CHF 10,000 and 0.25% on business accounts. Other types of accounts such as savings and time deposit accounts are not used directly for making payments.

² According to Article 6 of the Federal Coinage Law no one is obliged to accept more than 100 coins in payment.

2.2.2 Credit transfers

The overwhelming majority of cashless payments in Switzerland take the form of credit transfers. In 2000 a total of more than 545 million credit transfers were executed by the banks and Postfinance.

Bank and Postfinance customers have the possibility of issuing standing orders for regular payments. These payments are executed automatically on a date specified by the customer. This method is typically used for payments such as rent and health insurance premiums.

Cashless settlement of bills typically implies a payment slip. Two different payment slips are distinguished, a blue one and a red one. The blue payment slip has a reference number facility. Under this facility the person to whom payment is due, as a participant in the system, provides the debtor with a bill together with a payment slip which can be processed by OCR. If the beneficiary of a payment processed by Postfinance is a holder of a bank account or vice versa, the aggregate is transferred via SIC. The information pertaining to the transaction is, however, sent in different formats (from paper-based to different electronic forms) according to choice. The red payment slip, which is only issued by Postfinance, is still to some extent manually processed. Payment instructions delivered to Postfinance in this way are converted into a digital image and then transmitted to the payee. The obligations between Postfinance and the banks arising from such payment instructions are settled in SIC on an aggregated basis, whereas the information pertaining to the transaction is transmitted in various formats.

Customers have different possibilities for settling their bills. First, payment instructions can be sent by mail. Second, customers can submit their payment instructions through the internet. Third, banks and Postfinance provide payment services at the counter to their account holders. Only Postfinance allows non-account holders to effect payments in cash at the counter.

Swiss Post also offers a facility whereby the beneficiary can be paid the due amount at home by the postman. This used to be fairly common procedure with state pensions, although this service has become less important in recent years.

2.2.3 Direct debits

In 2000, the number of direct debit transactions by the banks and Postfinance amounted to 46 million, with a total value of CHF 70.8 billion. The direct debit procedure is mainly used for recurring payments, for instance, by credit card companies when they periodically bill cardholders or by insurance companies for the collection of premiums.

Consent of the debtor (payer) authorising a specific creditor (payee) to initiate debits (debit authorisation) is required before payments can be debited directly to his account. The creditor is responsible for obtaining the authorisation of the debtor. The creditor draws up the payment instructions on a data medium and sends it to Swiss Interbank Clearing AG for processing. The incoming data media are processed daily and the debtor's bank receives a list of payments to be made on data media or in paper-based form, according to choice. Since 1998, interbank obligations arising from such services have been settled in SIC. In certain cases, for instance where there are insufficient covering funds in the account or in the absence of the debit authorisation, debits may be rejected by the debtor's bank; the creditor is then responsible for recovering the amount due from the debtor.

2.2.4 Cheques

Cheques have never been widely used in Switzerland. Since 1989, the significance of cheques has continuously declined due to higher fees charged by the banks. An increasing density of cash dispensers and EFTPOS terminals may also have contributed to this decline. In 2000 a total of 11.2 million cheques were processed, amounting to CHF 27.7 billion.

Cheques drawn on banks are processed by the cheque centre run by Payserv Ltd. Cashed cheques are submitted by the banks daily to Payserv Ltd. In cheque processing the credit items for presenting banks and debit items for drawee banks are recorded on data media or in lists. Cheques normally remain with Payserv Ltd, where they are microfilmed. Postfinance also offers postal cheques.

2.2.5 Card payments

2.2.5.1 Credit cards

At the end of 2000 about 3.1 million cards were in circulation in Switzerland. The number of contracts between merchants and credit card organisations amounted to 303,000.³ Cardholders are normally charged an annual subscription fee, while merchants have to pay a commission based on the transaction value. Around 90% of outlets are equipped with direct lines to the authorisation centre. This allows for authorising a transaction automatically and simultaneously recording and transmitting the transaction data to the processing centre.

Transaction amounts are paid to the merchants periodically, typically by means of bank credit. Cardholders periodically receive a statement of transactions. The procedure for settling this bill is by means of a payment slip or by direct debit. Credit cards may also be used to withdraw cash over the counter at a bank or at cash dispensers. Use of this service varies because the cardholder is normally charged commission on each withdrawal.

2.2.5.2 Debit cards

Debit cards are issued by banks and Postfinance for their customers. Withdrawals by means of debit cards are debited to a cardholder's bank or post office account a day or two later. At the end of 2000 5.2 million debit cards were in circulation.

The debit card issued by Swiss banks is the EC card, which has a magnetic stripe enabling it to be used in EFTPOS systems and for withdrawing money from cash dispensers. For transactions at electronic terminals a PIN is used. Since 1997, every EC card has also been equipped with a chip so that the card may be used as a stored value card (e-money). Postfinance also issues the Postcard, which can be used with a PIN to withdraw money from cash dispensers, and in EFTPOS systems. Since it has the same chip as the EC card, the Postcard may also be used as stored value card.

2.2.5.3 Retailer cards

Various petrol companies, large retailers and retailers' associations issue their own cards, but these are valid only at their particular outlets. Customers normally receive a monthly statement of their purchases. No subscription fee is charged.

2.2.5.4 Cash dispensers

Switzerland has two cash dispenser networks in operation: the bank (Bancomat) network and the Postfinance (Postomat) network. Since autumn 1997, both the Bancomat and the Postomat networks have been made interoperable. In 1996 there were 3,654 cash dispensers in operation; by 2000 the number had increased to 4,866. In 2000, withdrawals amounted to 128.1 million transactions totalling CHF 25.3 billion.

The Bancomat and Postfinance networks operate online. Withdrawals from the Bancomat network may be made with EC cards and credit cards and also with bank cards from a bank's own cash dispensers. Additional facilities such as requests for statements of account and initiating payment orders are available only with a bank's own card at a bank's own terminals. With EC cards and credit cards up to CHF 1,000 a day may be withdrawn. The cardholder's PIN must always be entered in order to make a withdrawal. The verification of the PIN and other details is normally carried out centrally and online by the network operator (Payserv Ltd). Banks can also verify their own cards at their own cash dispensers and also process the transactions directly themselves. In addition, Bancomat and Postomat machines are equipped with a loading facility for stored value cards.

2.2.5.5 EFTPOS systems

There are also two independent EFTPOS networks, the bank network and the Postfinance network. However, the terminals installed may normally use both networks. A PIN must be entered. At the end

³ A merchant can accept cards of different credit card organisations. This total includes a merchant outlet twice if it accepts two different credit cards.

of 2000 there were a total of 141,032 EFTPOS processing possibilities at retail outlets and filling stations.⁴

2.2.5.6 *Electronic money*

On behalf of the Swiss banks, Europay (Switzerland) SA introduced the stored value card CASH in January 1997. The technology was adopted from the Belgian Proton System. CASH is a reloadable chipcard which is meant to substitute for currency, especially small amounts. The chip is attached to the EC card and to the Postcard. CASH is an account-related system. A maximum amount of CHF 300 per load can be transferred from the customer's account to the chipcard at every cash dispenser. In order to accept CASH at the point of sale, retailers have to install a terminal, which has, however, been offered with a rewarding price structure for early adopters. There are 3.4 million cash cards in circulation. In 2000, the number of purchase transactions was 18 million, with a value of CHF 67 million.

In 1998 Payserv Ltd started a project for credit card payments over the internet called SET (Secure Electronic Transaction). SET currently enables over 15,000 cardholders to make secure payments through the internet.

2.3 **Recent developments**

The banks have been working together for some time on preparing the introduction of an electronic bill presentment and payment (EBPP) facility called PayNet. Telekurs Holding, which developed PayNet, sold it to SAP AG in 2001. Telekurs, however, plans to market and operate PayNet in Switzerland in 2003 under licence from SAP. Yellowbill is the equivalent facility offered by Postfinance. EBPP facilities will enable the current procedures (ie paper invoices and payment slips are often sent together by mail) to be carried out electronically and in paperless form.

3. **Interbank exchange and settlement systems**

3.1 **General overview**

In Switzerland interbank cashless payments are executed via SIC, via retail payment systems such as DTA (a data media exchange facility) and LSV (a direct debit facility), and via cheque clearing. In addition to these systems, a giro system among the regional banks is operated under the auspices of RBA-Holding, an association of regional banks with over 80 members at the end of 2000. This system will not be dealt with any further here.

3.2 **RTGS: Swiss Interbank Clearing**

3.2.1 **General overview**

The role of SIC is to execute interbank payments in Swiss francs with immediate finality 24 hours a day with funds held at the SNB. It is a real-time gross settlement system, ie all payments are settled individually on the participants' accounts (debiting of the account of the bank issuing the payment instruction and crediting of the account of the receiving bank). In 2001 the message flow structure changed from a V- to a Y-architecture: the sending bank dispatches a payment message in the SIC system. At the same time, customer-relevant information relating to a transaction is no longer passed on to the SNB. Only after settlement does SIC send the payment message with confirmation of the settled payment to the receiving bank.

⁴ An EFTPOS terminal that processes debit card payments by Postfinance and the banks is counted as representing two processing possibilities.

The SNB oversees the SIC system, while Swiss Interbank Clearing AG, a subsidiary of Telekurs Holding Ltd, is under contract to provide the computer centre service. Private law agreements between these two parties and with the participating banks form the legal framework for the operation and further development of SIC. The contracts are supplemented by regulations and handbooks. Committees including representatives of the SNB and the participating banks submit changes and additions to the instructions and handbooks and take decisions on technical modifications to the application. All changes and additions require the SNB's approval.

3.2.2 Participants

Originally, participation in SIC was limited to banks domiciled in Switzerland and subject to supervision by the Federal Banking Commission. The only exceptions to this rule were domestic clearing organisations. Over the years, this policy has been increasingly challenged by developments in domestic and international financial markets. On the one hand, non-bank intermediaries have increasingly gained ground in financial markets and thus questioned the dominant role of banks in this area. On the other hand, globalisation of markets has brought about not only ever growing payment volumes, but also stronger competition among financial centres and associated cooperation and mergers between providers of financial market infrastructure. In the wake of these developments, conventional access policies have become outdated since these would particularly make cross-border projects such as the continuous linked settlement system (CLS) virtually impossible.

Against this background, the SNB decided, in 1998, to substantially liberalise its SIC access policy. For instance, it is now possible for supervised securities dealers such as non-banks to become SIC participants. More importantly, however, remote access to SIC is also granted to international joint ventures and clearing organisations, as well as the associated banks, provided these make a sizeable contribution to the reduction of systemic risks or are of major significance for the Swiss financial centre. For reasons of legal and operational security, this regulation only applies to joint ventures, clearing organisations, banks and non-banks from countries which have at least the same standards as Switzerland with respect to banking supervision, the fight against money laundering and the telecommunications infrastructure. At the end of 2000, 64 out of 306 SIC participants were so-called remote members.

Furthermore, Postfinance has been participating in SIC since 2000. As a large number of payment instructions, mainly retail payments, have to be transferred from the postal giro system to the bank giro system (and vice versa), Postfinance's participation in SIC has simplified the payment flows between the two systems. From a technical point of view, Postfinance sends its payments to banks through SIC in batches (ie payments to individual banks are added together). The information relating to these payments is, however, transferred via separate channels in various forms. The beneficiary then disaggregates the payments and credits customers' accounts according to the payment information.

3.2.3 Types of transaction handled

SIC is both a large-value payment system and a retail payment system; there are no value limits. In 2000 almost 150 million payments were executed, with a total value of approximately CHF 44.6 trillion. Moreover, the underlying transaction may be related to a bank's own business or be initiated by a customer. The bulk of payments is smaller than CHF 5,000. In terms of turnover, however, these small-value payments are negligible. Medium-sized payments between CHF 5,000 and 1 million account for about 17% of the total transaction volume. These payments generate about 4% of transfers in terms of turnover. Consequently, almost the entire turnover is accounted for by a small number of payments exceeding CHF 1 million.

The types of payments handled in SIC can be divided into four categories: (i) customer-related payments (transferor and transferee are non-banks), (ii) cover payments (sender and receiver are SIC participants), (iii) bank-to-bank payments (payments in which at least one of the parties is a bank that is not an SIC member), and (iv) service payments.

Customer-related payments account for about 86% of the transaction volume in SIC. But since customer-related payments are usually small-value payments, the amount in francs of these payments tends to be small. Cover payments generate 13% of the turnover. These payments are mostly related to interbank transactions such as money market transactions and foreign exchange transactions between SIC participants. More than two thirds of the turnover can be attributed to bank-to-bank

payments. These payments stem mainly from correspondent banking business and indicate the significance of foreign exchange transactions.

Service payments are related to the cash leg of securities transactions that are settled via the SIC-SECOM linkage and the settlement of obligations stemming from interbank payment services such as data media exchange or direct debiting. The share of service payments in terms of turnover has been increasing continuously. This increase can be attributed to two factors. First, settlement of the various retail payment systems has been integrated into SIC in the course of the last few years. Second, the repo platform was introduced in 1998. The sharp increase in repo transactions is mainly related to the fact that repos have become the main instrument of the SNB's monetary policy operations.

3.2.4 Transaction processing environment

Every bank is connected to the SIC system via the network run by Swiss Interbank Clearing AG. This network is available not only for SIC but also for other services provided by Telekurs Holding Ltd. The connection has been set up via the bank's own mainframe or a front-end computer; terminal connections are not permitted. All payment instructions must be authenticated using special equipment in order to prevent illicit insertion or alteration. However, encryption of transmissions is optional.

In case of technical problems at either individual participant level or system level, a number of backup procedures exist that provide for the possibility of timely settlement of payments. In particular, there are several measures to maintain the operability of the central SIC computer. For instance, emergency generators exist in case of a breakdown of the external power supply. A hot standby site is located about 20 km from the main site. Furthermore, in an emergency or in case of serious software problems, there is the additional alternative of switching to the so-called Mini-SIC, an offline batch application that can be run on any mainframe computer.

With respect to the SIC system's capacity, several concepts have to be distinguished. First, capacity in terms of entering payments (including validation) is limited to about 150,000 transactions per hour. However, once these payments are entered, up to 700,000 transactions per hour can be settled. Finally, the capacity for sending out notifications of settled payments to receiving banks is about 250,000 transactions per hour. Thus, given the fact that payments can be entered around the clock, these figures allow the extrapolation that theoretically about 3.6 million transactions per day could be settled in SIC. On peak days, about 2 million transactions are processed.

3.2.5 SIC operation

The prerequisite for participation in SIC is a reserve account at the SNB and an online connection to the central SIC computer. Payment instructions can be submitted for the same day value or for settlement up to five bank business days hence.

(a) Account structure

A specific feature of SIC is the account structure. Each participant's reserve account at the SNB is split into an SIC account and a master account. At the beginning of an SIC day, all reserve balances are held on the master account. To start the settlement cycle, funds are transferred (by the SNB) to the SIC accounts. Since cash withdrawals are settled on the master account, banks usually leave a certain amount of reserves on their master account. During the SIC day, settlement of interbank funds transfers occurs on the SIC accounts. Funds can be moved at any time from one account to the other. Finally, at the end of the day, total credits and debits of the SIC accounts are transferred to the master accounts. These end-of-day giro balances on the master account are relevant for accounting purposes.

(b) Queuing and settlement mechanism

The transfer of funds in SIC is subject to the strict condition that the bank issuing the transfer order holds adequate balances on its SIC account. In the event of insufficient coverage, the transfer order is automatically held pending until covering funds have accumulated in the account through incoming payments. The system automatically retries to settle pending payments. Within a specific order of priority, the FIFO rule applies. In a first step, for each account the next payment of the highest existing priority is determined. If there are sufficient funds available this payment is marked as a "settlement

candidate". Since there are many different accounts, it is very likely that there will be a large number of settlement candidates. Therefore, as a second step, among all the settlement candidates the algorithm selects the one that has the earliest input time. This payment is then settled. Having settled the settlement candidate or - if possible - a package of payments, the settlement algorithm starts again with the first step, and so on.

Additionally, the queuing mechanism in SIC is equipped with an automated optimisation routine that allows for bilateral offsetting. If there is a gridlock, the system starts after a few seconds to search at the top end of the queue for cross payments (from sender and receiver banks). If there is such a case, these two payments are netted, provided, however, that the cover rule is respected.

From an individual participant's perspective, the queue management is limited to the possibilities of cancelling and re-entering payment orders. The receiving bank is notified of any cancellations since it has real-time access to all data relating to its own account. Cash managers can thus continuously track current account balances and the amount of pending incoming and outgoing transfers. A cancellation signifies a reduction in these pending items. The information on pending payments becomes increasingly important towards the end of an SIC day, when liquidity managers have to decide whether, and to what extent, money market transactions are to be effected in order to have sufficient funds for carrying out pending payments or to bring reserve account balances in line with the desired level. The SNB, for its part, has access to all banks' transaction data stored by the system.

(c) Timing of the settlement cycle

SIC operates round the clock on bank business days. Settlement is carried out for approximately 22 hours. The day begins at 6 pm on the day before the bank business day in question with the transfer of giro balances from the master accounts at the SNB to the SIC accounts. The day ends in three stages on the bank business day in question. 3 pm is cutoff time 1. From this moment on, payments submitted for same day settlement are automatically changed to the value of the next bank business day. The only exception is the provision of cover, which can be submitted up to cutoff time 2 (4 pm) for same day settlement. After cutoff time 2 only payments submitted by the SNB are accepted for same day settlement. The end-of-day processing starts at 4.15 pm. These are set times, but in exceptional situations (eg in the event of computer or transmission failures) they can be postponed by the SNB. At the end of the day, totals of debit and credit transactions are transferred from the SIC accounts to the master accounts at the SNB.

The purpose of the hour's difference between cutoff time 1 and cutoff time 2 is to give banks with queued payments, ie with insufficient funds, the time needed to acquire the necessary covering funds on the market or from the SNB. In the quarter of an hour between cutoff time 2 and the start of day-end processing, only lombard (see Section 3.2.7) loans can be accepted. During the end-of-day processing, all the payments which are still queued, ie the settlement of which has not been possible, are deleted; they must be resubmitted the next day.

Pending payments which are cancelled after cutoff time 1 without the consent of the receiving bank or which are deleted during day-end processing are subject to a penalty of 500 basis points above the current money market rate. The receiving bank is entitled to claim this penalty from the bank which issued the payment instruction. The latter is obliged to pay this penalty without delay, irrespective of any further claims by the receiving bank.

3.2.6 Credit and liquidity risk and their management

(a) Credit risk

Credit risks arise if a receiving bank acts upon information available about pending incoming payments.⁵ In this case the receiving bank would de facto be extending credit to the sending bank (intraday or even overnight). However, the fact that the initiating bank can, at any time before clearing stop 1, cancel pending outgoing payments or payment orders for a later value date and that at

⁵ Information which the system gives to the receiving banks concerning pending payments is not legally binding and, as expressly laid down in the regulations, is not to be regarded as a binding assurance that funds will be transferred.

day-end pending payment orders are automatically deleted by the system helps to limit such behaviour.

(b) *Liquidity risk*

Payments which are still held pending in a queue file at the end of the day are automatically deleted by the system. The receiving bank therefore cannot assume that queued payments will be settled in every case. However, the staggered close of the clearing procedure, with cutoff times 1 and 2 and the time in between, gives banks the opportunity to acquire the necessary liquidity on the interbank market or in the form of lombard loans from the SNB.

3.2.7 Provision of credit facilities

Until recently, SIC was one of the few pure queuing systems. The SNB did not allow any overdrafts nor did it provide any collateralised intraday credits. Despite the well known argument that an RTGS system without any form of intraday liquidity would imply substantial liquidity costs for participating institutions, SIC operations generally ran fairly smoothly. Due to a liquid money market and sophisticated liquidity management by some market participants, the banks were able to gradually reduce their reserve balances. However, since October 1999 the SNB has been placing interest-free intraday credit at the banks' disposal. This change in policy was motivated mostly by an increase in time-critical payments. In particular, the future introduction of the CLS system for settling foreign exchange transactions will trigger an additional need to settle potentially very large payments without delay. Also, intraday credit from the central bank has the benefit of leading to shorter queues and earlier finality.

The link between SIC and SECOM (see Section 3.2.9) allows a very efficient and completely secure mechanism for granting intraday credit by means of intraday repos. Moreover, the use of intraday repos enhances the attractiveness of the repo platform for small domestic and for foreign financial institutions.⁶ This, in turn, raises the number of potential counterparties for the SNB's regular money market operations and thus facilitates the implementation of monetary policy. In the light of the Swiss money market structure, which is characterised by the dominance of a small number of large commercial banks, this argument is of particular importance.

For the time being, there are two time windows during which banks may draw on intraday credit: at the beginning of an SIC value day at 6 pm and at 8 am.⁷ Moreover, between 8 am and 2.45 pm banks may obtain further intraday credits on request. The banks can choose the time of the repayment themselves, but it has to be completed by the end of the settlement day. If an intraday credit is not repaid in time, a penalty rate exceeding the overnight rate by 400 basis points is applied.

The second form of credit extension provided to the banks is overnight money in the form of lombard loans. They are available only against pre-pledged collateral and at a rate of interest which is at present 200 basis points above the overnight rate. Lombard loans serve as short-term bridging liquidity.

3.2.8 Pricing policies

Prices are set at a level at which the expected SIC operating costs, including costs in respect of the Telekurs network and all line charges, are covered by the expected volume of transactions. If there are substantial discrepancies, prices can also be adjusted in the course of the year. Prices are set per transaction and charged to SIC participants. It is left up to each bank to decide whether and to what extent to pass charges on to its customers.

In 2000, the receiving bank paid a flat rate fee of CHF 0.06 per transaction. The sending bank pays a fee based on the sum of two components, one of which depends on the time of initiation and the other

⁶ The repo platform, also called Eurex repo, is the trading platform for Swiss franc repurchase agreements.

⁷ To be more precise, the first intraday repos are concluded at 4 pm but the liquidity is only provided after the beginning of the new SIC value day (an SIC value day starts at around 6 pm on the previous calendar day).

on the time of settlement. In addition, the fee partly depends on the size of the payment. The following table shows the prices valid for 2002.

Fee structure for the sending bank in 2002¹				
(in CHF)				
	Less than CHF 100,000		More than CHF 100,000	
	Input	Settlement	Input	Settlement
Before 8 am	0.01	0	0.01	0
8 am to 11 am	0.02	0.06	0.02	0.06
11 am to 2 pm	0.11	0.15	0.24	0.84
2 pm to 4.15 pm	0.40	0.40	1.00	2.00

¹ The receiving bank pays a flat fee of CHF 0.06 per payment. (Example: for a payment amounting to less than CHF 100,000 that is presented before 8 am and settled after 2 pm, the sending bank pays CHF 0.41.)

Besides the principle of cost recovery, the fee structure is conceived to make the input and settlement of payments at an early point in time worthwhile. Due to progressive fees, participants have an incentive to enter and settle their payments as early as possible. Moreover, it becomes more expensive to wait for incoming payments and thus to profit unfairly from opportunity cost bearing reserve funds of other banks. Furthermore, different fees are applied to small and large amounts, the latter consisting of CHF 100,000 or more. The fee structure provides an incentive for early input and settlement of small payments, which represent the bulk of SIC transactions. This, in turn, prevents the demand for input and settlement capacity to peak towards the end of a settlement day, ie at times when the occurrence of a gridlock would pose a major concern. Due to the progressive fee structure and the fact that payments larger than CHF 100 million are generally split into a number of tranches, gridlocks have never been a major problem in SIC - even before the introduction of the intraday credit facility.

3.2.9 Links with other systems

In March 1995 a link between SIC and the securities settlement system SECOM of SIS SegalInterSettle (formerly SEGA) was established. The link allows a real-time delivery versus payment mechanism in securities settlement by settling both the cash and the security side on a trade by trade (gross) basis. This eliminates principal risk in securities transactions. Furthermore, when the Swiss Stock Exchange switched from an open outcry system to an electronic trading platform in 1996, the new trading system SWX was linked to both SIC and SECOM. This linkage allows straight through processing from trading to settlement. In addition, cash flows resulting from Eurex, the Swiss-German derivative exchange, are also settled in SIC.

Ever since the early stages of planning, the objective has been to eventually provide for the settlement of various retail payment systems in SIC and thus to submit them to cover control. In May 2000, this process was completed by the integration of the settlement of cheques. Other retail payment systems that are settled in SIC comprise data media exchange (DTA), direct debits (LSV), cash withdrawals at ATMs, EFTPOS transactions (EC-direct) and transactions with prepaid cards (CASH). Interbank claims which arise from these systems are settled as debit payments on a gross basis at regular intervals - generally once a day - on the participants' SIC accounts.

3.3 Retail payment systems

3.3.1 The data media exchange facility (DTA) and direct debit procedure (LSV)

These systems enable payment instructions from bank customers to be processed electronically. Payment instructions are submitted by bank customers on diskettes, cassettes or magnetic tapes or

via file transfer to Payserv Ltd. At the same time the issuer of the payment instruction sends his bank a payment order (data media exchange) or a collection order (direct debit). The bank can then authorise Payserv Ltd to process the data.

The deadline for accepting electronically transmitted data is 2 pm for payments to be settled in SIC on the next bank business day. Subsequently, the payment instructions are processed, with calculation of the total credits and debits for each bank and delivery of the payment records to each bank. Once processing is terminated, the totals are transmitted to SIC for settlement. At 8 pm the output is ready for the banks.

3.3.2 Cheque clearing

Central cheque clearing is used for the processing of Swiss standard cheques, which takes place at Payserv Ltd. The bank at which the cheque has been cashed presents the cheque to Payserv Ltd, which microfilms and retains it. Swiss standard cheques must reach Payserv Ltd by 10.30 am for same day processing. After cheques have been processed, each bank receives the relevant details on data media and the totals for each bank. Settlement occurs on an aggregate basis in SIC.

4. Securities settlement systems

4.1 General overview and recent developments

4.1.1 Markets in Switzerland

Switzerland has well developed securities markets in Swiss corporate and government bonds, domestic and international equities, and money market instruments. There is also a highly developed market for derivative products. The most active participants in these markets are domestic and international banks and securities dealers and brokers, as well as institutional investors such as pension funds and insurance companies.

The SWX Swiss Exchange (SWX) offers trading services for a wide range of equity products such as Swiss and foreign equities, investment funds, rights, and warrants on equities and indices. Additionally, SWX lists Swiss franc bonds, Swiss and foreign Swiss franc convertibles and warrants on bond issues. SWX concentrates on the most liquid eurobond segments, ie bonds denominated in US dollars and euros. Incidentally, SWX is also proving its multicurrency capability with SWX Eurobonds (international bond issues) denominated in US dollars, euros, pounds sterling and yen. The SWX New Market is a segment of SWX especially designed for rapidly growing companies both from Switzerland and abroad. It provides these firms with a simplified means of entry to the international Swiss capital market.

All Swiss blue chips are traded through virt-x, a joint undertaking between the UK-based Tradepoint Exchange, the Tradepoint Consortium and SWX. Moreover, virt-x provides trading in pan-European blue chips of all major European indices. virt-x uses the electronic trading platform developed and used by SWX.

There is also a large volume of OTC activity in derivative products in Zurich. Standardised derivative products are traded through Eurex, the Swiss-German derivative exchange. Eurex provides its members and their customers with access to the complete European benchmark yield curve, from one- and three-month money market products based on Euribor to the long-term Euro Buxl future. Futures and options on futures for the Euro Bund, Euro Bobl, Euro Schatz and CONF are also traded on Eurex. In addition to options on German, Swiss, Finnish, Dutch, Italian, French and US stocks, futures and options on the German (DAX® and NEMAX 50®), Swiss (SMI®), Finnish (HEX25®) and European (Dow Jones STOXX 50SM and Dow Jones EURO STOXX 50SM) indices can be traded through Eurex. Eurex also launched futures and options on the Dow Jones Global Titans 50SM Index. Also available are futures contracts on Dow Jones STOXX 600SM, and options and futures contracts on Dow Jones EURO STOXX SM sector indices. The new products cover the euro zone and European area, respectively, in banking, technology, telecommunications and healthcare sectors. Finnish stock options as well as futures and options on the Finnish stock index began trading on the

Eurex platform as a result of a cooperation agreement between Eurex and the Helsinki Exchange (HEX). Enhanced product availability has also resulted from the launch of the a/c/e platform. Both CBOT® and Eurex products are now available on one liquidity network using the same technology. The a/c/e platform is operated as a joint venture together with the Chicago Board of Trade. In summary, Eurex provides participants with the most important worldwide index products, equity products, money market products and capital market products.

The repo market in Swiss francs was launched in 1998. Swiss and foreign participants can carry out their funding and collateral management operations directly on the interbank market as well as through the daily auctions of the SNB. Integrated clearing and settlement is the basis for secure, fast and cost-effective execution. Unique in the electronic repo environment, intraday contracts enable both national and international participants to organise their intraday liquidity management in Swiss francs in accordance with their particular needs. In March 2001, equity-repo trading with Swiss blue chips was initiated. With the introduction of the expanded facility, Eurex opened up the repo platform for collateralised funding business. With this, Eurex leads the way in consolidating the collateralisation of money market transactions. The introduction of a fully electronic primary and issue market represents a further modernisation of the Swiss financial centre. Auctions of new issues, which have so far been conducted mostly by phone and fax, as well as subsequent trading in the secondary market, can now be executed more efficiently. The Swiss Federal Finance Administration and the SNB have decided to use this platform for their auctions.

4.1.2 Swiss market infrastructure and its regulation

The Swiss Federal Act on Stock Exchanges and Securities Trading covers the exchange and clearing house operations of SWX and also provides the legal basis for self-regulation. Granted by the Federal Banking Commission (FBC), authorisation requires self-regulation. Within this legal framework, SWX provides a trading and matching platform for Swiss and foreign securities. It switched from an open outcry system to a central electronic system in 1996. Since June 2001, all Swiss as well as most pan-European blue chips can be traded on virt-x, which is under the supervision of the Financial Services Authority (FSA) and has been granted Recognised Investment Exchange (RIE) status.

Eurex was created by Deutsche Börse AG and SWX in December 1996 and founded through the merger of DTB Deutsche Terminbörse and SOFFEX (see Section 1.3.7). Both parties agreed to develop and implement a single platform for their derivatives markets and trade a harmonised product range. The operational and technical merger of the two markets was completed in September 1998, when all SOFFEX and DTB participants united on a common trading and settlement platform and the newly established Eurex clearing house commenced its activities. Eurex Clearing AG is a German registered corporation and its activities, like the exchange operations of Eurex in Germany, are subject to the provisions of the German Stock Exchange Act. The German Financial Supervisory Authority (BAFin) is the competent supervisory institution. Eurex AG is also subject to the legal supervision of the Ministry of Economics of the State of Hessen. The exchange and clearing house operations of Eurex in Switzerland are covered by the Swiss Federal Act on Stock Exchanges and Securities Trading. The legislation is the basis for self-regulation for Eurex (as for SWX).

FSG Swiss Financial Services Group (FSG) is another cornerstone of the Swiss market infrastructure. This holding includes SIS SegalInterSettle AG (SIS) as the most important subsidiary of FSG with regard to the Swiss market infrastructure. SIS is not only a national central securities depository (CSD), but also offers a broad range of cross-border services. SIS provides the securities settlement platform SECOM. This system allows for simultaneous, final, irrevocable delivery versus payment on an RTGS basis (real-time DVP model 1). All trades are matched and confirmed electronically on a real-time basis. SIS enjoys the status of a bank and is therefore supervised by the FBC.

SIC is an RTGS system operated by Swiss Interbank Clearing AG, a subsidiary of Telekurs Group, and is overseen by the SNB. The cash leg of securities operations in Swiss francs is settled in SIC. The banks' and brokers' SIC accounts are funded with central bank money from the reserve accounts that participants hold with the SNB. SIC AG was instructed by the Swiss financial community to develop a link to TARGET to settle payments in euros. For this purpose, it established the Swiss Euro Clearing Bank (SECB) in Frankfurt am Main. SECB operates euroSIC, a payment system linked to RTGS^{plus}, the German RTGS system connected to TARGET. Thus, for Swiss financial market participants euroSIC constitutes a link to the other European payment systems and provides an efficient cross-border gateway for payments to and from other European payment systems. euroSIC

operates on the basis of the software developed for SIC and runs on the same platform. As a German bank, SECB comes under the supervision of the Deutsche Bundesbank.

4.2 Trading, clearing and settlement

4.2.1 SWX

Trading

SWX has an electronic platform which ensures fully automated trading, clearing and settlement of all securities transactions. Electronic trading begins with the investor: participant banks' investment advisors register incoming orders from their customers in their trading system. These data are forwarded to the trader and checked, or fed directly into the trading system by the trader. From here, they are routed to the central exchange system of SWX, which acknowledges receipt of the order, assigns a time stamp to it and verifies its formal correctness. In the fully automated exchange system used at SWX, buy and sell orders are matched according to clearly defined rules (so-called matching rules). Regardless of their size or origin, trading orders, according to the SWX trading organisation, are executed on a price/time priority, ie in the order of price (first priority) and time received (second priority).

Exchange at SWX is divided into four periods: pre-opening, opening, continuous trading, and close of trading. Pre-opening starts at 5.30 pm on the previous business day and lasts until 10 pm. It resumes at 6 am on the current business day. Orders (bids and offers) may be entered or deleted in the electronic order book during pre-opening times, but no actual trades are made. A theoretical opening price is continuously calculated and displayed for the guidance of traders. The opening period determines the opening price and executes the orders according to the matching rules. This procedure takes place at 8.30 am for Swiss government bonds, at 9 am for stocks, at 9.15 am for derivatives and at 9.30 am for eurobonds, all other bonds and all other interest rate options. In order to establish the opening price (or upon resumption of trading after an interruption), the highest-execution principle is used; in other words, the price is fixed in such a manner as to achieve the largest possible turnover. After the opening period, continuous trading begins. New orders are continuously matched with existing ones. The matching rules are also applicable here. All orders are stored in the order book until a counterpart is found. Close of trading, which determines the daily closing price, starts at 5.20 pm and stops at 5.30 pm.

Clearing and settlement

SWX offers a securities exchange with a fully integrated electronic trading, clearing and settlement platform in which each trade triggers an automatic settlement. SECOM, SIC and euroSIC are linked to this comprehensive network. SIS operates the real-time settlement system SECOM, through which clearing instructions from SWX are automatically passed on for further processing on the settlement day. Depending on the settlement currency, transactions are routed via SIC or euroSIC. SIC and euroSIC ensure efficient and secure payment transfers in Swiss francs and euros respectively. Transactions in other currencies, as well as those in Swiss francs and euros on a credit basis, are settled directly via internal SIS accounts.

The purchaser and the seller undertake to settle all finalised on-exchange trades on the day fixed by SWX. The data are then transmitted from the SWX electronic trading system to the SECOM system. The data is entered by dealers when the order is recorded in the trading system, and the SWX system automatically makes any necessary adjustments. SIS debits the purchaser's SIC account with the agreed purchase price on the due date via a direct debit, and the corresponding amount is credited to the seller. At the same time, the securities are transferred - also automatically - from the seller's SIS custody account to that of the purchaser.

4.2.2 virt-x

Trading

virt-x provides a single open architecture platform which provides efficient, low-cost trading and straight through processing of trades from trading to settlement in European equities. The SWX

trading platform is used by virt-x. The aim is to implement automated securities trading, clearing and settlement at a European level.

virt-x is available for trading on all TARGET days, as specified by the European Central Bank. The operating hours of virt-x are 6 am to 10 pm. The trading hours are 9 am to 5.30 pm. The trading currencies are euros for euro countries and domestic currencies for the United Kingdom, Switzerland, Sweden, Norway and Denmark. Pre-opening starts at 5.30 pm on the previous business day and lasts until 10 pm. It resumes at 6 am on the current business day. Orders may be entered or deleted in the electronic order book during pre-opening times, but no automatic execution occurs during this period. A theoretical opening price is continuously calculated and displayed for the guidance of traders. The exchange confirms the member's order entry by order confirmation.

The opening period follows the pre-opening order book management period. During the opening period members may enter, modify or delete orders. No automatic execution occurs during this period. The market participants receive information on the situation in the public order book. All orders that are still valid from the previous day or which were entered on the trading day participate in this auction unless their execution is voluntarily restricted by the market participant. All executable orders are matched in the opening auction (uncrossing of the book). The beginning of price determination is random within a specific time interval, following the auction call, set by the exchange. The call has a random end in order to avoid price manipulation. At the end of the random minimum period the order book is frozen momentarily while the matching algorithm is run. No additional orders may be added or deleted until the matching process for that security is complete; incoming orders or deleting instructions are queued during this time and executed as soon as matching is completed. After price determination is concluded, the participants whose orders are, in part or in full, executed, are informed by a message confirming each execution that has occurred and giving all relevant trade information. The opening price is computed according to the highest-execution principle; in other words, the price is fixed in such a manner as to achieve the largest possible turnover.

Once the price determination process for each security has been completed, continuous trading in that security begins and orders can be entered, modified and deleted as before. All non-executed orders from the opening auction are forwarded to continuous trading unless otherwise restricted by the market participant. Thus, incoming orders are checked for matching against orders already in the book. All orders are stored in the order book until a counterpart is found or until they expire according to the parameter entered by the member. Close of trading, which determines the daily closing price, starts at 5.20 pm. The closing auctions stop at 5.30 pm.

Clearing and settlement

The virt-x market has been designed to have a single rule book and a fully integrated clearing and settlement system so as to gain the full efficiency benefits of a pan-European blue-chip equity market, namely maximum cost and productivity savings. Rather than dealing with the rules and settlement systems across Europe's 16 national equity markets, virt-x intends to offer its members the benefit of a single rule book and post-trade infrastructure covering trading and settlement for all blue-chip securities.

CRESTCo, Euroclear and SIS have developed fast and reliable links to provide a "virtual" single settlement system, offering virt-x members integrated, real-time, inter-CSD settlement at domestic rates. Whilst this infrastructure is a collaboration, the CSDs are also in competition, with each providing its own services. Members can choose a single CSD, or a combination of CSDs, to meet their settlement requirements. Through its own real-time link to the settlement system, virt-x is able to deliver settlement instructions for trades matched at the exchange to the relevant CSDs. This straight through approach minimises the possibility of post-trade uncertainty and potential delay and ensures high settlement rates. All order book trades are dealt for a uniform T+3 settlement period (subject to central bank holidays). The buyer is able to ask virt-x to enforce settlement if the seller has not delivered by the intended settlement date +2.

The London Clearing House (LCH) shall become the central counterparty for virt-x members in 2002. LCH will confer considerable member benefits, including full risk management, maintenance of anonymity from trade to settlement and optional netting. The virt-x integrated settlement solution is based on the cooperation of three interlinked CSDs. Each depository is able to support the settlement of all its customers' trades. Members may choose through which depository they wish to settle each jurisdiction of security. Thus members may employ one, two or a combination of all three CSDs to settle their virt-x transactions. Each depository maintains its unique service offering, facilitating

settlement between each other by real-time links. Each depository has provided an outline service description.

4.2.3 Eurex

Trading

Eurex operates a fully electronic platform on which trading takes place in three different phases. The pre-trading period is the initiating phase, during which users may make inquiries or enter, change or delete orders and quotes in preparation for trading. On the basis of the orders and quotes entered, a preliminary opening price is displayed. During the pre-trading phase, traders are in a position to assess supply and demand, and thus to determine their opening offers for prices of option series or futures contracts. During the so-called netting phase, Eurex counts up all the orders and quotes which have been entered, determining in this way the final opening prices of options series and futures contracts. The auction principle (ie highest-execution principle) determines the price.

Trading continues throughout the trading period. This is the actual trading phase, in which orders and quotes are matched and transactions are immediately confirmed online. During the trading period, all the trading functions are at the user's disposal. Trading ends with the post-trading period, where all inquiry functions are available and market, limit or stop trades for the next day may be entered. Stock market participants can enter these orders and quotes in the system for two hours after the trading period ends. All the inquiry functions are available during the so-called post-trading phase.

Market orders are matched immediately at the best available market price. Hence, with market orders, there is no guaranteed trade price. In options trading, market orders are matched as soon as possible at the best possible price. Market orders that cannot be executed are written to the order book until further quotes or tradable limit orders arrive. A market order is tradable when there are two opposite limit orders, which can both be executed, ie with a buy limit equal to, or higher than, the sell limit (crossed book). In futures trading, market orders are matched as soon as possible at the best possible price, but only within a maximum range around the last trade price. The size of the range is product-specific and determined by Eurex to make sure that market orders are only executed within an adequate range around the last traded price. Market orders that cannot be executed immediately are written to the order book.

The matching algorithm conforms to the price and time priority rule. This matching algorithm is basically used for all products. When a new order is entered, Eurex first checks the limits of the orders in the electronic order book and executes the orders with better limits before the orders with worse limits. A time stamp is assigned to all orders entered into Eurex to determine the chronological priority of the order for matching purposes. This time stamp is used to prioritise orders in the book with the same price. Market orders have the highest priority for matching. Since the purpose of the market order is to be carried out as quickly as possible at the best possible price, it must be entered without execution restrictions. In the case of limit orders, orders with the best possible prices (ie highest price limit for buy orders and lowest price limit for sell orders) take precedence in the matching process over other orders with worse prices.

When matching against an incoming order, the pro rata allocation algorithm takes into account each book order at the inside market price according to its percentage in overall volume, regardless of its time stamp. The elimination of time priority results in a larger number of orders contributing to a trade, since an incoming order is partially matched against a proportion of all orders at the current inside market price in the book.

Clearing and settlement

With its expansion to enable cross-border settlements and multicurrency clearing, Eurex now acts as the counterparty for the buyer and for the seller in every transaction and guarantees both parties to the transaction that the opening contracts will be performed. Therefore, the two parties to a contract are able to make their decisions independently of each other and to concentrate on the respective counterparty risk of Eurex only.

Every exchange participant admitted to trading at Eurex is required to participate in the clearing process of Eurex. The participant can choose to participate as a general clearing member (GCM), a direct clearing member (DCM) or a non-clearing member (NCM). GCMs and DCMs are both referred to as clearing members. NCMs are exchange participants without a clearing membership. Every type

of participation entails different duties and requirements. GCMs can trade on the exchange and perform the clearing for their own transactions, their clients' transactions and the transactions of exchange participants who do not have a clearing licence (ie NCMs). Moreover, GCMs are obliged to provide margin to Eurex, to guarantee and perform the delivery for all exercises and all assignments and to guarantee the cash settlement resulting from their own positions and transactions as well as those of their clients and NCMs. DCMs can clear their own transactions, those of their clients and affiliated NCMs.

Eurex was the world's first exchange to expand its remote membership policy and facilities, already valid for trading, to clearing. So-called remote clearing was introduced in August 2000. Participants from every country in the European Union and from Switzerland are not only able to participate in trading directly; they are also able to clear transactions themselves. At the end of 2000, there were 428 participants in Eurex.

Transactions in Swiss and German securities are settled on a delivery versus payment basis through SIS or Clearstream Banking Frankfurt. Both CSDs have set up omnibus accounts and established a cross-border DVP link. In addition to securities, clearing and settlement facilities, they also offer clearing members facilities for deposits of collateral. With the introduction of physically deliverable foreign currency products, a securities account is planned for the delivery of foreign securities. Cross-border cash settlements by Eurex are processed through the Landeszentralbank Hessen in Frankfurt am Main and euroSIC for euros, SIC in Zurich for Swiss francs and Clearstream Banking Frankfurt for other currencies. Physical deliveries of securities are made upon instructions of Eurex to Clearstream Banking Frankfurt or SIS.

4.2.4 SIS SegalInterSettle

FSG Swiss Financial Services Group (FSG) - owned by the Swiss banking community - includes SIS SegalInterSettle AG (SIS) as the most important subsidiary with regard to the Swiss market infrastructure. SIS not only performs CSD functions, but also offers a broad range of cross-border services. SIS provides the securities settlement platform SECOM. This system allows for simultaneous, final, irrevocable delivery versus payment on an RTGS basis (real-time DVP model 1). All trades are matched and confirmed electronically on a real-time basis. SIS enjoys the status of a bank and is therefore supervised by the FBC.

All domestic and foreign securities listed in Switzerland or traded over the counter are eligible for SIS, such as: bonds issued by domestic and foreign institutions, notes, money market claims, warrants, Swiss bearer and registered shares, foreign shares listed in Switzerland. To this end, all securities are provided with an identification number. They are referred to exclusively by this number when transactions take place. At the end of 2000, the volume of securities held at SIS was 66,440. The value of securities amounted to CHF 2.1 trillion.

The following institutions are eligible to participate in SIS: institutions subject to the Swiss Banking Law, domestic and foreign brokers and finance companies, clearing organisations, and other categories of participants who satisfy the admission criteria. At the end of 2000, there were 383 participants in SIS. All SIS participants are linked to SECOM via an online interface, which can be set up either via a computer-to-computer connection or by using SIS's own low-cost PC-based MAX User Device (Maximal Access to Extended Settlement Services). SECOM operates 24 hours a day on bank working days. Incoming instructions are processed individually in real time. The buy/sell instructions received from the buyer/seller of a security are pre-matched. On the execution date the seller's safe custody account is checked to ensure that there is sufficient cover. If this is not the case, the transaction is put into a queue file and executed automatically as soon as the purchases completed bring the total securities holding in the safe custody account up to the required level. If the total securities holding is sufficient, the sold securities are reserved in the seller's holding. The procedure on the financial side is as follows:

For processing transactions in Swiss francs, SECOM has an online connection with SIC. Once the securities have been reserved, SECOM generates a payment instruction and sends it to SIC, which processes this payment instruction like any other, ie SECOM payments, too, are settled only if there is sufficient cover. After settlement the payment is delivered to SECOM, which can then release the reserved securities and finally debit/credit them to the seller's/buyer's account. In 2000, SIS processed a volume of 14.5 million transactions, with a value of CHF 5,760 billion.

SIS is in the process of setting up links to central securities depositories in Europe to ensure that participants in other markets can also benefit from straight through processing (STP). Currently, there are automated links to Clearstream Frankfurt (only for Eurex and OTC transactions), Clearstream Luxemburg and Euroclear (only for eurobond trades) as well as to CRESTCo and Euroclear (for virt-x trades). SIS and CRESTCo form The Settlement Network. Further links are planned. In addition, SIS has a network of correspondents in all major markets around the globe.

4.3 The use of the securities infrastructure by the Swiss National Bank

The SNB makes intense use of the securities infrastructure. The repo platform, which was introduced in 1998, is used by the SNB to conduct its monetary policy operations. Auctions are usually conducted on a daily basis. Since October 1999, the SNB has offered intraday repos through the same platform. The corresponding depository services are provided by SIS. In addition, like any bank, the SNB relies on the services provided by SIS for its other business activities.

