

### 3 ASSET MARKETS AND THE FINANCIAL INFRASTRUCTURE

#### 3.1 THE FINANCIAL MARKETS

The US subprime mortgage crisis, which started in summer 2007, had a strong effect on global financial markets. The impact on the Czech markets was relatively limited and largely similar to the corrections seen in the previous two years, i.e. falling stock prices, stable long-term yields and appreciation of the koruna against the main world currencies. Nonetheless, some indicators suggest that the increasing global risk aversion was partially reflected in the Czech financial markets.

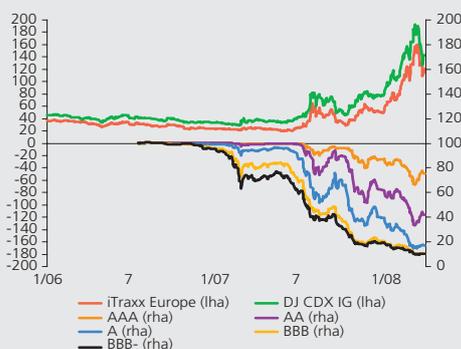
In mid-2007, the advanced financial markets experienced strong shocks (see section 2.1). In July, in an environment of rising interest rates and slowing property price growth, a surge in subprime mortgage defaults in the USA was reflected in a slump in the prices of bonds backed by these risky mortgages in all rating categories (see Chart III.1). The subsequent massive sales of risky structured products led to a virtual halt in trading in these products and caused an increase in global risk aversion. This affected other credit derivatives markets, particularly the CDS contracts market, where spreads widened considerably (see Chart III.1). The higher risk aversion was instantly reflected in prices of other risky assets and in rising volatility on stock, bond and foreign exchange markets.

The preceding several years of low volatility, global excess liquidity and search for yield had encouraged financial institutions, including many European banks, to invest in complex structured financial products, hedge funds and – via off-balance sheet exposures and credit facilities – in structured investment vehicles (SIVs, conduits) investing in bonds backed by risky assets. At the beginning of August, the sudden fall in the value of these investments raised strong concerns regarding the extent and particularly the distribution of the losses across individual banks on both sides of the Atlantic. This resulted in an increase in the perceived potential risk of counterparty default and in the interbank rates of major world currencies above the level of expected monetary policy rates (see Chart III.2).<sup>34</sup> The uncertainty regarding bank losses was strengthened by the activation of credit lines promised by banks to SIVs, which were no longer able to refinance themselves on the money market by means of short-term bonds. The increase in interbank rates also had a negative effect on banks that had no exposure to the US mortgage market and the related bonds and that only used the interbank market to finance their activities (e.g. Northern Rock in the UK). Since the interest rates at which the real sector is financed are often linked to interbank reference rates, the interest rate conditions in the real economy tightened significantly.

The increased risk of counterparty default on interbank markets resulted in a sharp fall in liquidity on the money markets at maturities longer than about 2 weeks, requiring massive interventions by monetary authorities in order to bolster market liquidity. The US Fed and other key central banks (the ECB and the Bank of England) reacted to the deteriorating money market conditions by increasing the liquidity offered in repo operations and later by changing the conditions for such operations, extending the maturities used to as much as 6 months and by coordinating the supply of liquidity internationally. The collateral accepted by

**CHART III.1**  
Developments on markets of subprime mortgage-backed securities and CDS contracts

(CDS indices in basis points; ABX-HE 2006-2 index by rating, in % of nominal value of backed securities)



Source: JP Morgan Chase

Note: The ABX-HE 2006-2 index includes bonds (incl. CDOs) backed by subprime mortgages granted in the second half of 2006.

**CHART III.2**  
3M money market rates and credit premium

(money market rates in %, credit premium in percentage points)



Source: Bloomberg

Note: Dotted lines denote market expectations of 3M money market rates derived from FRA contracts as of 1 Aug 2007 (in case of USD from LIBOR contracts). 3M credit premium is spread between 3M EONIA swap rate and 3M EURIBOR.

<sup>34</sup> Counterparty default risks on the interbank market can be measured using the spread between interbank rates and O/N swap rates at the same maturity. An O/N swap is an interest rate derivative where one counterparty pays the O/N rate on a daily basis and the other counterparty pays a fixed agreed (swap) rate on the agreed principal. In O/N swaps, the counterparties exchange only the net balance of the two rates, so the impact of counterparty default is very small and the credit risk is thus marginal, unlike in the case of interbank deposits, where the whole principal deposited with the counterparty is at stake.

central banks in these operations was also gradually extended. The Fed, and later also the Bank of England, introduced the option of borrowing government bonds against collateral in the form of mortgage-backed bonds, which can be interpreted as a measure also aimed at stimulating markets other than the money market. In addition, the Fed and partly also the Bank of England responded to the unfolding crisis and its expected impacts on the real economy by radically reducing monetary policy interest rates (see section 2.1), and both these banks made active use of their position as lender of last resort to save renowned financial institutions (Northern Rock in the United Kingdom and Bear Stearns in the USA).

Unlike the corrections in the previous two years (see Financial Stability Report 2006), the global financial market situation has yet to return to normal. Between the start of the crisis in summer 2007 and April 2008, the markets were very sensitive to the publication of global financial institutions' losses on risky subprime mortgages, news about the impact of the crisis on the real economy and the measures taken by monetary and supervisory authorities to bail out problem institutions and calm the situation. This period saw several dramatic falls on global stock markets, widening spreads on risky bonds, rising risk premia and volatility on a number of markets, and faster depreciation of the dollar (see Chart III.3). Long-term government bond yields in both the USA and the euro area fell in reaction to a "flight to quality" and to expectations that the financial crisis would have some impacts on the real economy. Some segments of the credit derivatives market are essentially non-functional. Asset prices reflect the insufficient market liquidity rather than credit risk, which further complicates the valuation of such instruments in the balance sheets of financial institutions and hence also the calculation of the total losses due to the credit crisis.

The Czech financial markets responded to the developments in global financial markets similarly as during corrections in previous years. Share prices went down in line with the falls in foreign stock markets, while bond yields initially declined slightly and then stabilised around 4.5% in March 2008 (see Chart III.4). This confirms the past experience that Czech koruna bonds are considered a relatively safe investment compared to the bonds of some other Central European economies. A downward revision of the expected future monetary policy interest rate path, in an environment of a potential cooling of the economy and an appreciating domestic currency, might also have played a role.

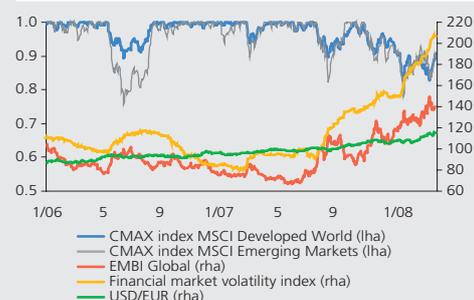
Nevertheless, it cannot be said that the global financial crisis had no major effect on the Czech financial markets. During 2008 Q1, market signals indicated increased sales of Czech government bonds by foreign investors, fostering a modest increase in long-term yields. Owing to declining yields on German government bonds, the long-term spread widened gradually. The spreads on euro-denominated Czech government bonds against euro area benchmark bonds decreased slightly at the beginning of the crisis and then started growing in reaction to the rising global risk aversion, similarly to the spreads on Hungarian and Polish eurobonds (see Chart III.5). Despite this increase, Czech eurobonds are maintaining some distance from Polish and Hungarian bonds. This partly reflected the Czech Republic's better long-term sovereign rating, which indicates its ability to repay foreign-currency liabilities (see Chart III.6).<sup>35</sup>

Given the heavy participation of foreign banks in the Czech financial sector, concerns might arise about potential spill-over of the problems caused by the losses

CHART III.3

### Turbulence on global financial markets: risky assets, USD exchange rate and volatility

(EMBI Global, volatility indicator and USD/EUR as index, 1 Aug 2007=100; CMAX index = ratio of current value of stock index to maximum value in past 60 days)



Source: JP Morgan, Bloomberg

Note: EMBI Global Index – weighted spread of yields on dollar-denominated emerging markets bonds; Financial market volatility index – sum of historical volatility of S&P500, DJ Eurostoxx, 10Y US and German bonds, EUR/USD exchange rate and JPY/USD exchange rate over past 90 days.

CHART III.4

### The 2007 crisis: impact on stock and bond markets in the Central European region

(CMAX index = ratio of current value of the stock index to maximum value in past 60 days, lha; 10Y yields in %, rha)



Source: Bloomberg

CHART III.5

### The 2007 crisis: impact on 10Y yield spreads on bonds denominated in euro

(in basis points)

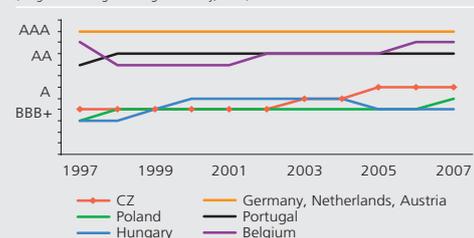


Source: JP Morgan, Bloomberg

CHART III.6

### Development of sovereign rating of selected countries

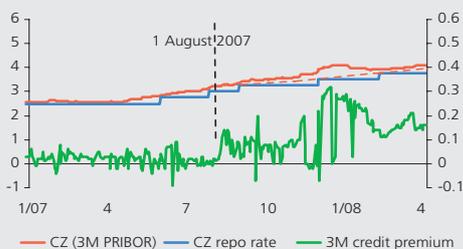
(long-term rating in foreign currency, Fitch)



Source: Fitch

<sup>35</sup> Rating issues are dealt with in the article *The Role of Ratings in Financial Sector Stability Assessment* in the thematic part of this Report.

**CHART III.7**  
**Czech koruna money market development**  
 (rates in %, lha, credit premium in percentage points, rha)



Source: Bloomberg, Reuters

Note: Dotted lines denote market expectations of 3M money market rates derived from FRA contracts as of 1 Aug 2007. 3M credit premium is spread between 3M CZEONIA swap rate and 3M PRIBOR.

due to the current crisis from parent institutions to their subsidiaries. Short-term koruna rates increased in the first phase of the turbulence in line with the expected monetary policy tightening. The money market recorded a modest increase in the credit risk premium, although a much smaller one than in the euro area (see Chart III.7). Market liquidity also declined in this market (see Box 4).

#### Box 4: Financial market liquidity

Financial market liquidity (market liquidity) is generally regarded as the ability of market participants to execute financial transactions in assets of a given volume without causing a significant change in their prices.<sup>36</sup> The term "liquidity" can also be encountered in the context of the need to safeguard liquidity within a particular financial institution (see Box 7). It refers to balance-sheet liquidity, i.e. an institution's ability to meet its immediate commitments. The two concepts of liquidity are more or less interconnected. The stability of a financial institution is closely linked to financial market stability through liquidity risk management by the institution and, conversely, through the provision of liquidity to the market via its participation in this market.<sup>37</sup>

This box focuses on the derivation of market liquidity indicators – an composite indicator for the entire Czech financial market as a whole and separate indicators for the individual markets. It is based on calculations containing key information across the selected markets (the money, bond, foreign exchange and stock markets) and also across the separate attributes of market liquidity, including market tightness, depth and resilience and the liquidity risk premiums. Market tightness (short-run position turnover costs) can be measured by the width of bid-ask spread. In general, a market maker on an illiquid market will increase the width between bid prices and ask prices as compensation for the difficulty of realising a prompt sale of an asset he holds. Market depth (the ability to execute large transactions without excessively affecting the current market prices of an asset) and market resilience (the speed at which prices recover from a random shock) can be determined using indicators based on the ratio of the yield to the transaction volume. The final market liquidity calculation included here is an estimate of the liquidity premium. This can be understood as a form of compensation demanded by an investor for the potential risk of having to abandon the position associated with uncertain future market conditions. The individual sub-indicators were normalised before aggregation.

The composite market liquidity indicator (liquidity index) for the Czech financial market indicates relatively sharp rise in financial market liquidity between the

**CHART III.1 (Box)**  
**Composite market liquidity indicator for the Czech financial market**



Source: CNB, Bloomberg, Datastream

<sup>36</sup> A detailed definition of a liquid market (as applied to the stock market) can be found in Black, F. (1971): Towards a Fully Automated Exchange, Part I. Financial Analysts Journal, pp. 29-34.

<sup>37</sup> Take, for example, a bank facing a balance-sheet liquidity shortage. The bank will try to sell assets on the market to raise the necessary funds. If, however, it faces an illiquid market, the intended sale may be very difficult to realise and the prices of its assets may fall under supply pressure. In the extreme case, this may trigger a spiral of rising sales of assets to raise additional funds and a related further decline in prices.

end of 2004 and mid-2007 (see Chart III.1 Box).<sup>38</sup> Similarly constructed liquidity indices for the euro area and UK financial markets<sup>39</sup> suggest a similar rise in market liquidity in recent years (since mid-2003) and a rapid fall since mid-2007.<sup>40</sup> This indicates some global basis for the evolution of this indicator and also confirms the increased integration of European financial markets. In the period under review, market liquidity has also decreased on the foreign exchange market, stock market (see Chart III.3 Box) and money market (see Chart III.2 Box). By contrast, the Czech government bond market is relatively liquid and its liquidity index shows the opposite trend (see Chart III.2 Box). This may indicate increased caution on the part of investors on those markets with falling indices (a lower number of buyers and sellers on the market, a higher liquidity risk premiums, etc.), or, conversely, a search for a potential safe haven on the government bond market at a time of increased market volatility associated with rising investor uncertainty (a flight to quality).

The market liquidity index does not include an exhaustive number of market liquidity measures, so further refinement to include other possible measures could have an effect on it. It is also impossible to eliminate from the primary market liquidity index certain temporary investor behaviour that is not necessarily related to market liquidity but may have at least some short-term effect on liquidity (e.g. speculation on increases in monetary policy rates). It is also important to say that the measures included remain relevant for defining liquidity on various markets, but only at times of relative quiet. At times of market tension, when the price volatility is higher, the significance of market participants' behaviour, which is often over-sensitive or herd-like, increases. In such a situation, market participants assign an unhealthy higher weight to market liquidity (compared to risk and yield), so it is more difficult to determine the relevant nominal or market value of an asset at such times.

The koruna's exchange rate has followed an interesting path since summer 2007. At the start of the crisis, the koruna appreciated dramatically, probably due to the liquidation of carry trades for which the koruna was used as the financing currency, in an environment of growing global risk aversion (see Box 5). The attractiveness of the koruna for carry trades decreased in October 2007 owing to rising interest rates and higher exchange rate volatility (see Chart III.8). The following period, however, saw a further strengthening of the appreciation trend, driven both by a shift in foreign investment away from the depreciating dollar and towards appreciating currencies such as the Czech koruna, and by domestic exporters, who in an environment of faster appreciation of the koruna started hedging on a mass scale by selling euros.

CHART III.2 (Box)

## Market liquidity indicators for the money and bond markets



Source: CNB, Bloomberg, Datastream

CHART III.3 (Box)

## Market liquidity indicators for the koruna and stock markets

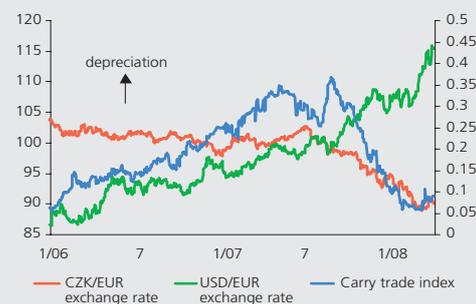


Source: CNB, Bloomberg

CHART III.8

## CZK/EUR exchange rate: the role of the attractiveness of carry trades and dollar development

(exchange rates: 1.8.2007=100,lha; carry trade index as 3M interest rate spread of CZK against EUR for a unit of implied volatility, rho)



Source: Bloomberg

<sup>38</sup> The liquidity index is constructed so that its values indicate the number of standard deviations from the historical average. It is a combination of nine individual liquidity measures, three of which involved measurements based on bid-ask spreads: (1) the CZK/EUR, CZK/USD, CZK/GBP and CZK/CHF exchange rates, (2) the 12 most liquid shares in the PX index, and (3) 28 government bonds; a further four fall into the category of liquidity risk premiums estimates: (4) the spreads between interbank deposit rates and the monetary policy repo rate, (5) the spreads between interest rate swaps and government bond yields, (6) the historical volatility of the CZK/EUR exchange rate and (7) the Czeonia reference interest rate; and the last two comprise (8) the yield-to-trade volume ratio and (9) the yield-to-market capitalisation ratio for the 12 most liquid shares in the PX index. The individual composite indicators are then the unweighted average of the individual liquidity indicators normalised on the period 2000–2/2008. The whole time series is subsequently smoothed using the Hodrick-Prescott filter.

<sup>39</sup> ECB, Financial Stability Review, June 2007, p. 81; Bank of England, Financial Stability Report, April 2007, p. 18.

<sup>40</sup> ECB, Financial Stability Review, December 2007, p. 92; Bank of England, Financial Stability Report, October 2007, p. 10.

### Alternative scenario C: "Loss of confidence"

Scenario C assumes a different impact of the current turbulence on the Czech economy. As in Scenario A, there would be a cooling of the global economy and thus also of the euro area economies, and domestic economic activity would decline sharply. Global risk aversion would rise further, reversing the previously positive attitude towards the Czech koruna and leading to a radical depreciation (a "loss of confidence"). Although the weaker koruna would partly help the export-oriented corporate sector, it would on the other hand generate a large increase in inflation, to which the central bank would react by raising rates.

This combination of macroeconomic variables would lead to a rise in the default rate, generated primarily by low GDP growth and high rates. Share prices would fall and property prices would also see a modest decline. Growth in lending would slow to a very low level.

### Box 5: Carry trades and the exchange rate of the Czech koruna

Carry trades became a phenomenon in 2006 H2 and 2007 H1. This speculative transaction can be described generally as an investment in a high-yielding currency financed by a loan in a low-yielding currency. The classic case was investment in currencies such as the British pound and the Australian or New Zealand dollar financed by loans in Japanese yen or Swiss francs. Owing to low interest rates in the Czech Republic, the Czech koruna became another popular currency for financing such trades at the start of 2007.

In practice, financial derivatives (mainly forwards and swaps) are used more frequently for carry trades, as they enable investors to achieve the same exposure with lower administrative demands. Credit lines are far less burdened and swaps spreads are narrower than those for cash transactions. It is thus cheaper for an investor to create the required position. The purchase of higher-yielding British pounds and the sale of lower-yielding Czech korunas through an outright forward would be a typical example of a carry trade using derivatives. In the future, usually two business days before the forward matures, the higher-yielding currency is sold and the lower-yielding currency is purchased, thereby finalising the transaction. This strategy allows the investor to make a profit from the interest rate differential between the British pound and the Czech koruna for the time period until maturity date of the forward.

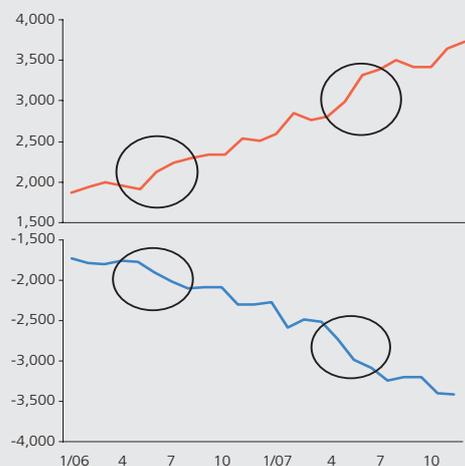
When investing in carry trades, the investor always bears the exchange rate risk stemming from future exchange rate fluctuations of the currencies used. The investor cannot hedge against such risk by using standard financial derivatives, as he would thereby forfeit profit from the interest rate differential. A change in the exchange rate can thus force the investor to abandon an investment in a carry trade earlier than expected, where the exchange rate loss would be higher than the gain from the interest rate differential.

It is not easy to prove the use of the koruna as a carry trade financing currency. One way might be to analyse the off-balance sheet of the banking sector. As it is financial derivatives that are mainly used for investment in carry trades, growth in such instruments should be visible in the balance sheet of

CHART III.4 (Box)

#### Fixed-term CZK operations vis-à-vis non-residents in banking sector off-balance sheet

(CZK billions; upper chart assets, lower chart liabilities; figures in value of underlying asset; circled areas denote March-June period in 2006 and 2007)



Source: CNB

the banking sector at times when such positions are created or closed. Unfortunately, the data on derivatives in the off-balance sheet do not allow us to observe the direction of the trade (purchase or sale) or to distinguish them from other derivatives transactions used for other purposes (for example, hedging against exchange rate risk).

The aggregate data for the Czech banking sector show a sizeable increase in the volume of derivatives in spring 2007 (see Chart III.4 Box) – of about EUR 20 billion in March–June in euro terms (a rise of 20%, compared to less than EUR 5 billion, or 6.5%, in the same period of 2006). This can be partly explained by exporters' hedging interest at a time when the koruna was depreciating. However, this depreciation of the koruna and the increase in the off-balance sheet might also have been partly due to the financing of carry trades using financial derivatives. Furthermore, when analysing the balance sheet of the domestic banking sector, one needs to bear in mind that it does not include all koruna transactions, but only those where the reporting bank was a counterparty to the transaction. According to the BIS Triennial Survey and the CNB, a large proportion (one-quarter to one-half) of koruna transactions might take place off the Czech foreign exchange market.

Another way of demonstrating the use of the koruna for carry trades is to analyse the co-movement of the exchange rates used for such strategies, i.e. the Japanese yen and the Swiss franc in addition to the koruna. Investors' sentiment in relation to these transactions often develops regardless of the currency from which the position is financed. The use of the yen to finance carry trades can also be proved by the International Money Markets (IMM) data published by the Commodity Futures Trading Commission – the US exchange regulator, on the difference in the numbers of speculative futures contracts for the purchase and sale of the relevant currency. Co-movement of the koruna and the yen would thus indirectly confirm the role of the koruna as a financing currency (see Chart III.5 Box).

The market data show that the exchange rates of the koruna, yen and franc against the reference currencies were relatively strongly correlated in certain parts of the year. Given the developments on global markets and the rise in interest rates in the Czech Republic, it is likely that the koruna-financed carry trades were terminated at the end of summer 2007 and no longer occur to any great extent now. While the opening of carry trades probably fostered depreciation of the Czech koruna in 2008 H1, their termination in H2 contributed to its appreciation.

CHART III.5 (Box)

**Exchange rates of currencies used to finance carry trades and carry trade indicator from IMM data**

(currencies as indices, 13 January 2000 = 100, right-hand scale; IMM data as difference in numbers of contracts for purchase and sale of JPY futures, in thousands, left-hand scale – inverted)

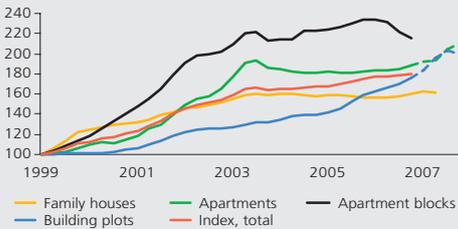


Source: Bloomberg

### 3.2 THE PROPERTY MARKET

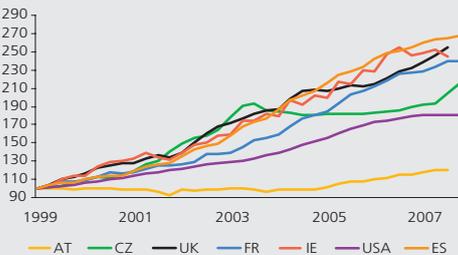
*The property market trends identified as risky in the 2006 Financial Stability Report continued into 2007. Property prices in the Czech Republic rose relatively fast in 2007 despite the problems on real estate markets in many advanced economies. Besides the favourable macroeconomic situation, record demographic characteristics also played a role. The Czech Republic saw converging prices across individual regions and individual property types. The rise in property prices led to a rise in the ratio of flat prices to wages and a decline in the rent return, which fell below the level of mortgage lending rates. Prague seems to be the most risky region in terms of these indicators. It also has the highest intensity of housing construction. The large number of flats under construction may pose risks to the property development sector.*

**CHART III.9**  
Property prices – transfer prices according to tax returns  
(absolute index; 1999 Q1 = 100)



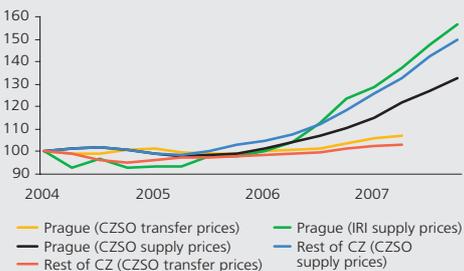
Source: CZSO, CNB calculation  
Note: 2007 data preliminary or calculated from supply prices

**CHART III.10**  
Property prices – international comparison  
(absolute index; 1999 Q1 = 100)



Source: BIS, CZSO  
Note: Country abbreviations given in list of abbreviations.

**CHART III.11**  
Property prices – transfer prices and supply prices  
(absolute index; 2004 Q1 = 100)



Source: CZSO, IRI

The relatively fast property price growth seen since 2006 H2 continued during 2007. Prices of flats and building plots recorded particularly high growth (a 23% rise in supply prices year on year). Prices of family houses rose more slowly (by less than 5%). Prices of apartment blocks, for which only 2006 data are available, recorded an absolute fall, following previous years of growth. As in previous years, the prevailing price growth was driven mainly by rising demand for housing. This demand is due, for example, to rising household income, dynamic growth in loans for house purchase in an environment of low interest rates,<sup>41</sup> demographic factors<sup>42</sup> and also "forward buying" factors associated with the rise in the standard VAT rate on 1 January 2008 (see section 2.1).

Since the credit crisis in the USA can be seen in direct relation to the interaction of mortgage lending and property prices (see Box 1), one can ask whether the current relatively fast growth in prices of most types of property in the Czech Republic will lead to a similar situation. The importance of finding an answer to this question is emphasised by the fact that property prices have started falling in some of the other countries where buoyant growth in prices was recorded in previous years (see Chart III.10).<sup>43</sup> Within the EU, the Czech Republic ranks somewhere between the countries with relatively high price growth (Spain, Ireland, the UK, France, etc.) and those where property prices have tended to remain flat in the past (Germany and Austria). However, prices have been stagnating mainly in economies geographically close to the Czech Republic, which are its major trading partners. The direct impacts of the mortgage crisis are thus not likely to affect the Czech property market quickly. This is confirmed to some extent by the conclusions in Box 6 *Identifying property market bubbles*.

The apartment price growth identified above implies uncertainties associated partly also with the inadequate quality of the property price source data. Comparing the rises in prices of flats in Prague with those in the rest of the Czech Republic for various sources (see Chart II.11), it is apparent that the current relatively fast growth in supply prices is not completely in line with the growth in transfer prices according to the CZSO, which are rising much more slowly. It is possible that transfer prices will be revised upwards or that their low growth is due to non-market effects such as tax optimisation,<sup>44</sup> but the increasing difference between supply prices and final transaction prices can be viewed as a sign of falling market liquidity or rising risk on the property market.

Convergence of prices across regions is also apparent. This is reflected by higher growth in supply prices for the rest of the Czech Republic compared to Prague (see Chart III.11). Convergence of prices can also be seen across individual property types classed according to degree of wear and tear. This can be identified by comparing the growth in the supply price indices for Prague according to the IRI and the CZSO, which are constructed in slightly different ways. The IRI index

<sup>41</sup> The direction of the causality between property price growth and growth in house purchase loans remains an issue. However, analyses suggest that loan growth to prices prevails. See also the discussion of Chart III.1.5.

<sup>42</sup> According to preliminary CZSO data, the population grew by 93,900 people in 2007. This increase is even higher than those recorded during the 1970s "baby boom" and only slightly lower than those in the post-war period. Unlike in these periods, when the rise was due almost exclusively to natural population growth, the current increase is being driven mainly by record immigration (83,900 persons). However, even the natural population growth was the highest in 25 years.

<sup>43</sup> In addition to the USA, some declines in prices can also be observed in the property markets in Ireland, the UK and Spain, although for the most part these declines are not yet included in the given time series.

<sup>44</sup> The data for the CZSO's property transfer prices are sourced from prices given in property transfer tax returns.

measures the price of a "standard" flat,<sup>45</sup> while the CZSO supply price index covers all types of flats, including those with less wear and tear. The larger increase in prices according to the IRI may thus suggest convergence of prices of lower-quality flats towards those of higher quality.

The large rise in supply prices of flats together with considerably lower increases in supply rents led to a further fall in the rent return in 2007 (see Chart III.12).<sup>46</sup> For most large cities in the Czech Republic, the rent return is below the level of long-term bond yields and the level of interest rates on new loans for house purchase. This means a lower rate of return and a higher degree of risk associated with speculative property purchases financed by mortgage loans. The decline in the rent return may potentially imply an increase in the risk of loans provided to property developers. Such companies currently specialise in selling flats after completion and are not directly affected by a decline in the rent return. However, if their assumptions regarding future prices fail to materialise or if they fail to sell their properties, they might be forced to let them. In this case, a decline in the rent return coupled with higher interest rates could mean losses for them. But no major rise in market rents can be expected in the near future, given the ongoing rises in regulated rents.

As mentioned earlier, property prices are also closely related to household income growth. If property prices rise too fast relative to household income growth, households could become overleveraged and any fall in prices would then have negative impacts on consumption and their ability to repay their obligations. The risk of such a development is described by the price-to-income indicator (the ratio of property prices to household income, see also Box 6). Although this indicator has recently been rising for most regional capitals (see Chart III.13), it is still below its end-2003 highs.<sup>47</sup> Although wages in Prague are about 25% higher than the average in the Czech Republic, the price-to-income ratio identifies Prague as the riskiest region. Generally speaking, regions with lower incomes and higher unemployment have lower price-to-income ratios.

Easier access of households to loans for house purchase has undoubtedly been one of the major factors underlying the property price increases in recent years. The link between property prices and mortgage loans is clear both from the development of these two variables over time and from the distribution of the value of mortgage loans across individual regions. Regions with a higher average mortgage amount<sup>48</sup> also show higher prices of flats (see Chart III.14). The correlation between the two indicators is high (0.9). Nevertheless, in terms of interpreting the increase in property prices, the direction of the causality between the two indicators is also important. If the property price growth is being driven by increased demand stemming from greater availability of loans for house purchase, this could be interpreted as convergence towards the standard features of property markets in advanced countries. Such convergence would be relatively risk-free. However, if the property price growth is exerting upward pressure on mortgage loans through a need to increase the average mortgage value, the risk of a bubble on the property

CHART III.12

**Rent returns**

(averages for period in %; comparison with yields on 10Y government bond and house purchase loan rates)

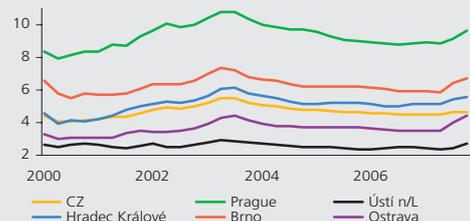


Source: IRI, CNB

CHART III.13

**Price-to-income ratios**

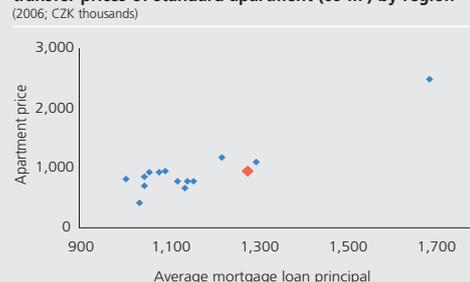
(ratio of price of 68 m<sup>2</sup> apartment to wage for last 4 quarters)



Source: CZSO, CNB calculation

Note: 2007 data preliminary or calculated from supply prices

CHART III.14

**Average size of mortgage provided to households and transfer prices of standard apartment (69 m<sup>2</sup>) by region (2006; CZK thousands)**

Source: MRD, CZSO, CNB calculation

Note: Average for Czech Republic in red

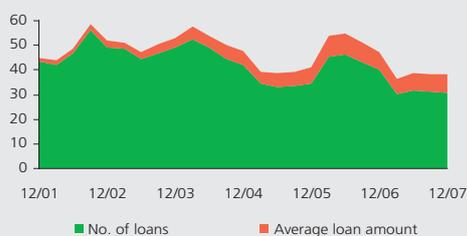
<sup>45</sup> A flat with wear and tear of 40% located outside the city centre, often in a prefabricated "panel" block of flats, i.e. flats whose prices tended to be low in the past.

<sup>46</sup> The rent return is calculated as the one-year supply rent divided by the supply price of the flat.

<sup>47</sup> The decline in the indicator in 2004–2006 was associated with a stagnation in prices of flats amid rising income.

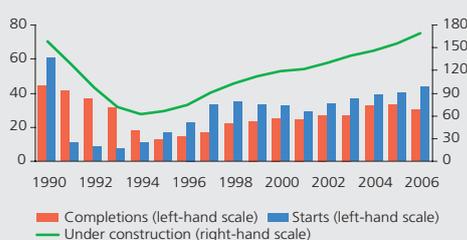
<sup>48</sup> The average mortgage amount is calculated from data given in the Ministry for Regional Development's publication *Selected Data on Housing*. The data give the contractual principal of mortgage loans granted, which is higher than the real amount of the loan drawn. The data are gathered from surveys of banks and are thus not fully comparable with the loan data in the CNB's statistics.

**CHART III.15**  
Contributions to household mortgage loan growth  
(year-on-year increases in %)



Source: CNB, MRD

**CHART III.16**  
Apartment construction  
(numbers of starts, completions and apartments under construction in given year in thousands)



Source: CZSO

market would be higher. In this case, the effects of a bursting of the bubble on households' balance sheets and their ability to repay their loans would also be higher. It can be derived from the data on mortgage loans that the past buoyant growth in mortgage loans was due more to their rising number. The contribution of growth in the average mortgage amount has so far been relatively low (see Chart III.15). This confirms the generally accepted hypothesis that the causality runs from house purchase loans to flat prices and that the current growth in flat prices is relatively risk-free. On the other hand, there has been a clear rise in the contribution of the average size of mortgage loans to their total growth. This has grown from 5% to 20%.

With prices rising, the fast growth in housing construction continued into 2007 (see Chart III.16). The numbers of completions, starts and flats under construction rose year on year (completions by a significant 38%), reaching record highs for the Czech Republic. As in previous years, the housing construction was concentrated mainly in Prague and the surrounding Central Bohemian Region, which accounted for 43.3% of housing completions. In terms of completions per 1,000 inhabitants, the intensity of housing construction in these two regions was more than 2.5 times higher than in the rest of the Czech Republic (7.6 completions per 1,000 inhabitants, compared to 3.0 in the rest of the country). The growing number of housing completions was also reflected in an increase in the total number of flats, which according to our estimates has risen by 4.2% since 2001.<sup>49</sup> The number of flats per 1,000 inhabitants has increased from 427 in 2001 to about 440.<sup>50</sup> Most of the properties completed were intended for sale, as reflected in an increase in the share of owner-occupied housing from about 50% in 2001 to the current more than 60% (data from the CZSO's household budget survey). The question is whether the market for new housing will be satisfied in the foreseeable future by the increasing supply and whether the large number of flats under construction will pose problems for developers (see the "property market crisis" scenario). This risk may be exacerbated by the aforementioned increasing gap between transfer prices and supply prices, the decline in the rent return and tighter bank credit standards for loans to such companies.

### Box 6: Identifying property market bubbles

This box mentions selected approaches to identifying unbalanced developments on property markets, in particular ways of identifying "bubbles".<sup>51</sup> Property market bubbles can have serious implications for

<sup>49</sup> The total number of existing flats was estimated on the basis of the number of flats determined in the latest *Census of people, houses and flats* (CZSO) in 2001. The number of housing completions in 2002–2007 was added and the number of flats cancelled in the same period was deducted (based on the building permit statistics). However, it should be added that this is only a rough estimate. For example, the number of flats increased by 292,000 in 1991–2001 (based on the census), while the number of housing completions was only 226,000 in the same period. According to the CZSO, about one-half of this disproportion was due to administrative changes in existing flats (declarations of additional flats in a single house, restitutions, etc.), while one-half was due to a physical increase in the number of flats, for example through reconstructions of existing non-residential buildings. To what extent such effects are significant today remains an open question.

<sup>50</sup> This ratio is higher than in Austria (421 flats per 1,000 inhabitants in 2004), Belgium (409), Ireland (400) and the Netherlands (422) and lower than in Germany (477), France (513) and Sweden (486). Source: *Housing Statistics in the European Union 2005/2006*.

<sup>51</sup> An asset price bubble can be defined simply as an explosive and asymmetric deviation of the market price of an asset from its fundamental value, with the possibility of a sudden and significant correction. Asset price bubbles are often caused by psychological and behavioural factors, self-fulfilling expectations, etc. The possibility of the onset of a property price bubble in the Czech Republic was mentioned, for example, in the 2006 Financial Stability Report.

macroeconomic stability and the development and soundness of the financial sector. Empirical research tells us that when property price bubbles burst, the implications for the real economy are more serious than in the case of a bursting stock market bubble.<sup>52</sup> Property market bubbles also pose a greater threat to a country's financial stability if the banking sector is more exposed to such assets through investment in real estate or through mortgage-backed loans.

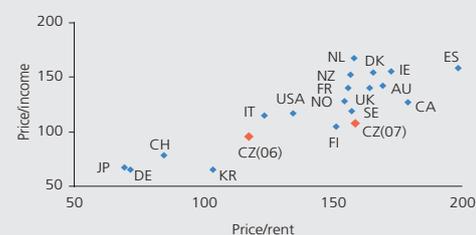
The "practical approach" to identifying bubbles is based on analysing simple ratios and comparing them with the long-run (average) historical value of the given ratio. The *price-to-income* and *price-to-rent* ratios are used most frequently. They denote, respectively, the ratio of flat prices to household income (wages) and the ratio of flat prices to market rents.<sup>53</sup> Higher values of both indicators imply a higher probability of a price bubble. A comparison of the two indicators (see Chart III.16 Box) suggests relatively overestimated property prices, for example, in Spain and Ireland (the upper right-hand corner of the chart) and underestimated property prices in Japan and Germany (the lower left-hand corner of the chart). Our estimate of the comparable<sup>54</sup> indicators for the Czech Republic does not suggest strongly overestimated property prices. However, both indicators recorded sizeable increases last year.

The use of ratios does not guarantee correct identification of a bubble, as the hypothetical fundamental value of a property includes apart from information about income and rent also a number of other determinants, such as growth in house purchase loans, growth in construction output, interest rates, demographic factors (e.g. population growth) and the size of the property market. The shortcomings of the "practical approach" are addressed to some extent by the "econometric approach" to bubble identification, which compares the market value and the estimated fundamental value of the asset. The application of the econometric approach to the data for the Czech Republic is hindered by the short time series of key indicators and the instability of the estimated coefficients over time, which, in turn, is related to changes in the structural characteristics of the property market (e.g. rent deregulation). The assessment of bubbles in the Czech Republic as a transition economy is further complicated by the fact that the property markets here have shown signs of underestimation in the past. It is thus difficult to distinguish whether the current price growth is due to convergence towards the averages of the advanced economies or whether a bubble is developing.

CHART III.6 (Box)

**Relationship between price-to-income and price-to-rent indices for various countries**

(long-run average = 100, 2006 except CZ 07)



Source: Datastream, CZSO, IRI, CNB calculation  
Note: Country abbreviations given in list of abbreviations.

<sup>52</sup> See, for example, Helbling, T., Terrones, M. (2003): Real and Financial Effects of Bursting Asset Price Bubbles. IMF World Economic Outlook, April 2003. The effects of bursting property price bubbles are accompanied by greater output losses and last longer on average (about 4 years) than the effects of bursting stock market bubbles (about 1.5 years).

<sup>53</sup> The price-to-income ratio is therefore the inverse of the "rent return" used in Chart III.12 of this Report.

<sup>54</sup> For the advanced economies in the chart both indicators are related to their long-run averages for 1990–2006, while the indicators for the Czech Republic are compared with their averages for 2000–2006. The shorter period for the calculation of the averages for the Czech Republic puts some limitations on their comparability.

### 3.3 THE FINANCIAL INFRASTRUCTURE

In 2007, financial stability continued to be supported by the smooth operation of the interbank payment system CERTIS and the short-term bond system SKD,<sup>55</sup> both of which are administered by the Czech National Bank. These systems recorded no irregular situations in the period of turbulence in global markets. The CNB aims to safeguard the quality and security of the services provided and monitors current developments and trends in the European financial infrastructure. The further development of the capital market in the Czech Republic and its external competitiveness would benefit from the existence of a central securities depository, but this still remains in the preparatory stage.

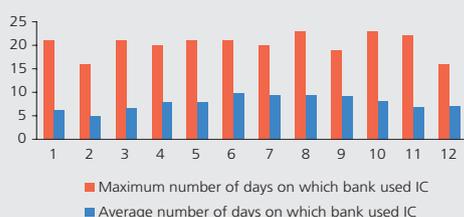
The Short-Term Bond System (SKD) is used for issuing and registering all book-entry securities with maturities of up to one year and for settling trades in these securities. T-bills and CNB bills are registered in SKD. The system enables sales of securities, repos and sell and buy operations, as well as pledges and exchanges of securities. CERTIS (Czech Express Real Time Interbank Gross Settlement System) processes all domestic interbank transfers in Czech koruna in real time.

The volume of transactions processed in SKD was gradually rising between 2000 and 2006, and amounted to almost CZK 47,000 billion in 2007 (see Table III.1). An average of CZK 185 billion was processed every day. SKD's turnover in roughly 19 days equalled annual nominal GDP.

Smooth and stable interbank settlement is supported by the use of intraday credit (see Table III.1). In 2007, the volume of intraday credit grew by around 4% compared to the previous year to CZK 7,152 billion. This meant a continuation of the previous years' steady upward trend in the volume of intraday credit as banks became more aware of how it can be used. Through SKD, the CNB provides CERTIS participants with interest-free intraday credit to boost their balance-sheet liquidity during the day. All intraday credit extended to commercial banks by the CNB is collateralised. The credit is used regularly by about 15 banks, five of which use it to a greater extent. While some banks use the credit almost every business day in the month, others use it either not at all or only rarely. Therefore, the average number of days on which banks used the credit was around 8 days<sup>56</sup> in 2007 (see Chart III.17). However, it is not possible to determine whether banks used the credit more frequently in any particular period of 2007. As regards the volume of credit, higher – but not extreme – amounts were used between June and August (see Chart III.18). It appears, then, that Czech banks did not need to use this instrument more often, despite the liquidity problems in global financial markets.

CERTIS ran smoothly, with a continued upward trend in the number of payments settled (see Table III.2). CNB Clearing processed 411 million items totalling CZK 174,854 billion, up by 15% compared to 2006. The average daily number of items processed was 1.64 million and the average daily value of the items was CZK 697 billion (see Charts III.19–III.21). These figures reveal the extent of payment settlement in CERTIS and its significance for financial stability. It took roughly five days to reach a turnover equal to annual nominal GDP.

**CHART III.17**  
Average and maximum number of days in month when banks used intraday credit (2007)



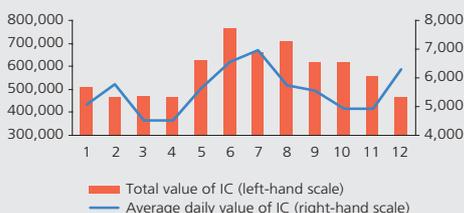
Source: CNB

**TABLE III.1**  
SKD – statistical information

Period	Total value of transactions (CZK billions)	Total number of transactions	Total volume of intraday credit (CZK billions)
2000	23,258	27,350	n.a.
2001	22,865	22,334	n.a.
2002	32,418	16,615	n.a.
2003	39,040	17,029	2,493
2004	40,713	16,214	3,055
2005	38,742	14,552	3,557
2006	47,534	13,810	6,884
2007	46,902	12,870	7,152

Source: CNB

**CHART III.18**  
Total and average value of intraday credit (2007)



Source: CNB

**TABLE III.2**  
CERTIS interbank payment system – statistical information

Period	Turnover (CZK billions)	Average daily turnover (CZK billions)	No. of transactions (millions)	Average daily no. of transactions (millions)	Average GDP/Average daily turnover
2002	100,343	431	262	1.12	5.6
2003	96,938	385	317	1.26	6.6
2004	110,127	434	333	1.32	6.4
2005	123,354	488	356	1.40	6.0
2006	151,537	604	382	1.52	5.3
2007	174,854	697	411	1.64	5.1

Source: CNB

<sup>55</sup> A more detailed description of these systems was published in the 2004 Financial Stability Report. Risk management and the evaluation of these systems against international standards was dealt with in the 2005 Financial Stability Report.

<sup>56</sup> Average for banks that used the credit at least one day in the month.

As regards number of items, non-priority items transferring lower amounts are dominant in the long term. Items with amounts of up to CZK 100,000 account for 96% of all transactions in the month. By contrast, in terms of the volume of the funds transferred, the remaining 4% of the number of items represent more than 98% of total turnovers. Items with amounts of over CZK 10 million account for 0.1% of the number of items and 94% of turnovers. An analysis of the monthly turnovers of priority items in 2005–2007 reveals that ten participants in the system are regularly the biggest payers into the system and simultaneously the biggest payment recipients (about 87% of the total turnover). Each of them receives and sends payments to more than ten participants. The maximum share of monthly turnover of a single payer in the total monthly turnover is 20%. The shares of these biggest payers are roughly the same for the comparable periods of 2005–2007 (see Chart III.22).

In order to test the contingency plan, CERTIS items were processed at the backup facility on two days of 2007. The test confirmed that the CERTIS system can be run fully at this facility if necessary.

### Central depository

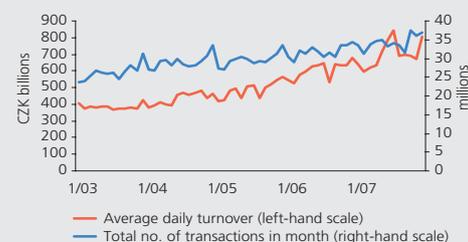
The basic infrastructure of the Czech capital market for the registration and settlement of investment instrument transactions is currently highly fragmented and thus inefficient. One of the main reasons is that there is still no single central entity – a central depository – maintaining a securities register and performing transactions settlement as is the case in the advanced capital markets.

Transactions in investment instruments are settled by Univyc, a.s. (exchange and off-exchange transactions), RM-S, a.s. (transactions concluded on the over-the-counter market it organises) and the CNB (the short-term bond market). However, all domestic book-entry and immobilised securities are still registered by the Czech Securities Centre. Univyc maintains a register of physical and foreign securities, while the CNB maintains a register of short-term bonds in SKD. Cash settlement is performed by Univyc, a.s. through the CNB's clearing centre and by RM-S through ČSOB, a.s. Transaction settlement is thus fragmented and associated with high transaction costs. After the central depository opens for business, registration of investment instruments and settlement of transactions, along with other related activities, will be performed by this single entity, which should lead to more efficient settlement of transactions in investment instruments, lower transaction costs and also reduced operational and credit risk. Only entities subject to state supervision will be granted direct access to the central depository. This will increase the security of the investment instrument register maintained at the central depository, and will also reduce costs. These costs are currently high, partly because the register at the Czech Securities Centre is accessed through counters. Although discussions about establishing a central depository have been going on for years, the groundwork has still not fully been laid for it.

### Monitoring of European trends

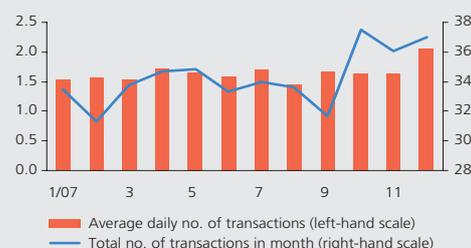
CNB representatives work in the relevant ECB committees and working groups and monitor the development of the four key European infrastructure projects, which advanced fairly significantly in 2007: progress towards the single euro payment area (SEPA), the launch of TARGET2 and CCBM2 (a single shared platform for collateral management) and the preparation of TARGET2-Securities (a common technical platform for the settlement of securities transactions in central bank money).

**CHART III.19**  
CERTIS interbank payment system  
(number of transactions processed in 2003–2007)



Source: CNB

**CHART III.20**  
Number of transactions processed by CERTIS in 2007  
(millions)



Source: CNB

**CHART III.21**  
Average daily turnover in CERTIS in 2007  
(CZK billions)



Source: CNB

**CHART III.22**  
Share of largest payers in total CERTIS turnover in priority items  
(%, ten largest payers, data for May of respective year)



Source: CNB

The aim of SEPA is to unify payments in the EU so that consumers can pay in euro under the same basic conditions regardless of whether they are making a national or cross-border payment. SEPA is based on the application of uniform European standards for credit transfers, direct debits and card payments (SEPA rulebooks). The system of SEPA rulebooks for credit transfers was successfully launched in January 2008. More than 4,000 European institutions joined it from the very beginning, including several banks in the Czech Republic. The application of SEPA rulebooks for direct debits is expected in 2009 and for card payments between 2008 and 2010. The ultimate goal is for the critical mass of payment transactions in the EU to migrate to SEPA by the end of 2010.

The approval of the Directive on Payment Services in October 2007, which is supposed to be transposed into the law of the EU Member States by 1 November 2009, is considered the key step towards the implementation of SEPA. Among other things, the directive removes the previous uncertainty regarding the direct debit rules. The approved scheme is based on the principle that the direct debit payment process can be only initiated by the payee, which will mean a change in current Czech practices.<sup>57</sup>

The Eurosystem's new payment system for large and urgent payments TARGET2 was successfully launched on 19 November 2007. It is based on a single technical platform shared by all users. It will replace the decentralised TARGET system, which has been in operation since January 1999. A total of 259 banks from 8 countries joined the new system in the first stage. Another 13 EU countries joined in two subsequent migration waves on 18 February and 19 May 2008.

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<sup>57</sup> In most Western European countries, a contract between the payer and payee must be submitted to the payee's bank. The bank maintains a database of such contracts and checks payees' identification numbers. A different system applies in the Czech Republic. A database of mandates is administered by the payer's bank. The bank decides whether to approve the debit from the payer's account based on whether the payee's request matches the data in the database. This means the principle in the Czech Republic will be reversed.