

## FINANCIAL INTEGRATION AT TIMES OF FINANCIAL (IN)STABILITY

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*This article analyses the phenomenon of financial integration on both the theoretical and empirical level, focusing primarily on assessing the impacts of the current financial crisis. In the theoretical section we first look at the definition of financial integration and summarise the benefits and costs associated with this process. We go on to examine the relationship between financial integration and financial (in)stability, emphasising the priority role of financial innovation. The subsequent empirical section provides an analysis of the speed and level of integration of the Czech financial market and the markets of selected inflation-targeting Central European economies (Hungary and Poland) and advanced Western European economies (Sweden and the UK) with the euro area. The results for the Czech Republic reveal that a process of increasing financial integration has been going on steadily since the end of the 1990s and also that the financial crisis caused only temporary price divergence of the Czech financial market from the euro area market.*

### 1. INTRODUCTION

Structural changes in the economic environment, such as real synchronisation of economies or advanced financial integration, affect economic agents and institutions<sup>1</sup> both individually and systematically. Integration can increase the investment opportunities of individual financial institutions, allowing them to make higher returns at the same level of risk. On the other hand, if individual financial institutions are exposed to the same risks<sup>2</sup>, the risks of their portfolios as a whole are not necessarily diversified at all and the positive effect of market integration may thus be reduced. Moreover, the financial sector as a whole may be more vulnerable to systemic risk and contagion risk in conditions of high geographical and sectoral integration of the banking and other financial markets. Whether the benefits of deepening financial integration outweigh the risks, and whether this process will lead to increasing financial stability, depends largely on the resilience and flexibility of the financial system itself, which national and international authorities should be working to enhance.

This article primarily analyses the financial integration of the Czech financial market (the money, foreign exchange, government bond and equity markets) with the financial market of the euro area (or Germany for the government bond market) at times of financial (in)stability. The article also includes analogous results for selected inflation-targeting Central European economies (Hungary and

Poland) and advanced Western economies (Sweden and the UK). The article is structured as follows. Section 2 looks at the definition of financial integration and summarises the benefits and costs associated with this process and then examines the relationship between financial integration and financial (in)stability. Section 3 summarises the methods for measuring financial integration and discusses in detail the results of an empirical analysis of the impact of financial (in) stability on financial integration. Section 4 concludes.

### 2. FINANCIALLY INTEGRATED MARKETS AND FINANCIAL (IN)STABILITY

A commonly used definition of “financially integrated market” is that of Baele et al. (2004) and Weber (2006), i.e. the market for a given set of financial instruments and/or services is fully integrated if all potential market participants with the same relevant characteristics (1) face a single set of rules when they decide to deal with those financial instruments and/or services; (2) have equal access to the above-mentioned set of financial instruments and/or services; and (3) are treated equally when they are active in the market.<sup>3</sup>

This broad definition of financial integration contains three important features. The first is that it does not require financial structures to be identical within regions. It is natural for individual countries (regions) to have their own financial architecture and this need not be a barrier to financial

1 Central banks, national governments and financial institutions.

2 Identical risks arise because of, for example, the choice of a similar portfolio and/or the similarity of “aggregate” risks. These risks are amplified by investors’ traditional search for yield.

3 Most definitions of financial integration are closely linked to the law of one price (i.e. assets having identical risks and returns should be priced identically regardless of where they are transacted). The law of one price allows for quantitative measures of financial integration (see section 3). However, fulfilment of the definition based on the law of one price does not automatically mean achievement of full market integration – see the broader definition of financial integration given above.

integration. The second feature is linked with the existence of frictions in the financial intermediation process, which can persist even after a high degree of financial integration has been achieved and which should affect the integrating regions symmetrically. The third feature stems from the separation of the supply of, and the demand for, investment opportunities (the creditor and debtor sides respectively).<sup>4</sup>

Financial integration generates benefits and costs for individual entities, be it directly or indirectly. Many research papers, e.g. Edison et al. (2002), Agénor (2003), Baele et al. (2004), Komárková and Komárek (2008) and ECB (2010), point to the need for a detailed knowledge of these costs and benefits in order to maximise the benefits and minimise the costs associated with the financial integration process. The experience of the ongoing financial crisis has increased the importance of this debate. The most frequently mentioned benefits of financial market integration include: (i) consumption smoothing due to international diversification of risks, (ii) the positive effect of capital flows on domestic investment and economic growth, (iii) improving efficiency of the financial system, and (iv) increasing prudence of financial market agents and the attainment of a high level of financial stability. The major costs include: (i) insufficient access to funding at times of financial instability, including capital concentration and procyclicality, (ii) inappropriate allocation of capital flows, (iii) loss of macroeconomic stability, (iv) herd behaviour among investors, financial contagion and high volatility of cross-border capital flows.

There is a relatively large body of research on the relationship between financial integration and globalisation,<sup>5</sup> but the implications of financial integration for financial stability (and vice versa) remain largely unstudied and less clear. However, the financial crisis has greatly increased the interest of economists and regulators (who are often also monetary policy-makers) in studying the relationship between financial integration and financial stability in depth. The question therefore arises whether financial integration supports financial stability or fosters financial

instability, or conversely whether financial (in)stability affects financial integration (see section 3).

An integrating market fosters financial stability by improving access to international capital markets and thereby increasing the opportunities for investors, creditors or debtors to diversify their investment risks. Financial stability is also aided by easier growth in the size of financial intermediaries (through the removal of barriers to free trade or as a result of stronger stimuli emanating from expanded markets). Larger institutions can better reap the benefits of an expanded and integrated market and can also better withstand potential shocks than institutions of local significance.

Conversely, a strongly integrated market does not foster financial stability if the financial system is not sufficiently resilient and flexible to shocks (e.g. contagion risk or systemic risk), which are transmitted more rapidly through an integrated market. The more active financial institutions are in the financial markets, the more likely it is that those institutions will be systemically relevant. If those institutions get into difficulties themselves, they can undoubtedly contribute to financial instability in the economy. What is more, if the number and size of the institutions active in international markets rises, the risk arising from their business crosses geographical borders all the more and all the faster.

The financial integration process has also been fostered over the past decade by massive financial development, especially through financial innovations.<sup>6</sup> In the past, such innovations tended to foster diversification of risks (especially credit risk) within the national economy and thus stabilisation of the financial system. In recent years, however, the increased popularity of financial innovation has fostered misallocation of capital and risk across market participants. One of the main innovative products – and simultaneously a stimulant of international financial integration and a cause of the current crisis – has been securitisation.<sup>7</sup> It was securitisation that enabled the integration of various financial market segments, such as the illiquid mortgage market with the liquid bond market.

4 A highly integrated market requires the same access to financial intermediation or trading, clearing and settlement platforms for both parties regardless of their country of origin.

5 For more on the definitions of these terms, see Komárková and Komárek (2008).

6 The financial system is affected both by financial integration and by financial development. Financial integration affects, for example, the competitiveness of individual financial institutions and increases the room for risk diversification and risk sharing, even when market frictions are assumed to be present. Financial development helps to eliminate such frictions – see Hartmann et al. (2007).

7 Securitisation is a process whereby a set of illiquid assets producing a known or at least sufficiently accurately predictable cash flow (e.g. mortgages, leases, credit card debt, consumer loans and even copyrights) is transformed into a marketable security.

Another innovative product which supported financial market integration from a general perspective was resecuritisation.<sup>8</sup> This product, or rather its complexity, was simultaneously a cause of the crisis. In particular, such investments were difficult to value. The vast majority of investors relied on the results of rating agencies using similar valuation models heavily dependent on several input assumptions. In the deteriorating economic conditions, each resecuritised security could be rated variously.<sup>9</sup> A security that cannot be correctly valued quickly loses its liquidity and book value when the market gets nervous, leading to large losses in holders' balance sheets.<sup>10</sup>

A fundamental challenge for the regulatory and supervisory authorities is to minimise the negative impacts of financial market integration on financial stability without reducing the benefits of this process. Examples include increasing market transparency, limiting over-complicated financial instruments and introducing macro-prudential supervision to ensure timely warnings of the formation of imbalances or contagion across markets.

### 3. THE FINANCIAL INTEGRATION OF THE CZECH REPUBLIC AND SELECTED INFLATION-TARGETING COUNTRIES WITH THE EURO AREA

This section examines whether, and how quickly, individual segments of the financial markets (the foreign exchange, money, government bond and equity markets) of the Czech Republic and selected inflation-targeting countries of the Central European region (Hungary and Poland) and advanced Western economies (Sweden and the UK) are integrating with the euro area and what impact the current financial crisis has had on this integration process. An empirical analysis is conducted for the period January 1999–January 2010. In order to analyse the impact of financial stability on financial integration this period is divided into a pre-crisis period (January 1999–July 2007), a core crisis period

(August 2007–April 2009) and a subsequent calm-down period (May 2009–January 2010).

In line with the definition of financial integration based on the law of one price (see section 2), two methods were used to measure financial integration<sup>11</sup>: (i) price-based measures and (ii) news-based measures.<sup>12</sup> The more the individual segments of the euro-candidates' financial markets are integrated with the euro area, the more the prices of these assets will be affected by common (global) factors rather than by local (national) factors. It can also be expected that with growing integration the individual segments of the financial markets will be a less likely source of asymmetric shocks.

*Price-based measures* are applied in accordance with Adam et al. (2002), who used the concepts of beta-convergence and sigma-convergence.<sup>13</sup> The concept of beta-convergence enables identification of the speed at which differences in yields are eliminated on individual financial markets. A negative beta coefficient signals the existence of convergence, and the magnitude of the beta coefficient expresses the speed of convergence, i.e. the speed of elimination of shocks to the yield differential of individual asset prices vis-à-vis the euro area. The closer the value of the beta coefficient is to -1, the higher is the speed of convergence. The concept of sigma-convergence captures the dispersion of the differences between the yields on identical assets in different countries at a given moment in time and thus identifies the degree of integration vis-à-vis the euro area achieved at that moment by the individual financial market segments in the countries under review. Sigma-convergence arises if and when the sigma coefficient falls to zero. Beta-convergence may, but need not, be accompanied by sigma-convergence. In fact, sigma-divergence may occur. Both concepts must therefore be tracked concurrently in order to assess financial integration.

*News-based measures* originate in Baele et al. (2004) and simply monitor the sensitivity of asset prices to local and global news. The technique is based on the assumptions that

8 Resecuritisation involves packaging already securitised products into a single investment for subsequent (re)selling.

9 Moreover, with the pressure of systemic risk rising, slight inaccuracies in the parameter estimates generated high probabilities of default even for securities with high ratings – see ECB (2010).

10 "Mark-to-market" (fair-value) accounting, which was originally meant to help investors quickly obtain information on the value of their balance sheet assets, ultimately proved misleading for balance-sheet valuation in conditions of inability by the market to value assets correctly (Cifuentes et al., 2005; Plantin et al., 2008).

11 Both methods are described in detail in Babeckii, Komárek and Komárková (2007) and CNB (2009).

12 Another approach to measuring financial integration is that based on quantity-based measures. This approach involves monitoring the cross-border barriers (analysing the cross-border activity of market participants and also "home bias") faced by financial market participants.

13 The terms beta-convergence and sigma-convergence originate in the economic growth literature – see, for example, Barro and Sala-i-Martin (1992).

in a fully financially integrated area portfolios are perfectly diversified and the degree of systematic risk is identical across assets in different geographical parts of the integrated area and so local factors are not significant. For individual countries, sensitivity is measured by gamma, which expresses the degree of sameness of reaction to news between prices of domestic assets and prices of benchmark assets.<sup>14</sup> Put differently, gamma represents the proportion of the change in asset prices which can be explained by common factors. Higher values of this parameter signal greater integration. Values greater than 1 indicate a multiplication effect, i.e. a stronger response of the price of a local asset relative to the benchmark asset. Negative values express an asymmetric response to news.

Table 1 shows the beta-convergence analysis results for the individual segments of the financial markets in the defined periods, while Chart 1 shows those for sigma-convergence. Chart 2 presents the results of the news-based analysis.

### Pre-crisis period

This period was characterised by gradually increasing convergence across all the markets and countries under review in terms of both convergence level (sigma) and convergence

speed (beta). The comparatively high beta coefficients indicate that the individual financial markets of the economies under review were integrating relatively quickly with the markets of the euro area (or Germany in the case of government bonds). The beta coefficients were broadly similar in value for the given countries and markets. The money market was converging the slowest and the foreign exchange and equity markets were converging the fastest on average.<sup>15</sup> In addition, the value of the sigma coefficient suggests that just before the crisis the level of integration differed only slightly in the countries under review (sigma in the range of 0.4–1.2). The exceptions were all the sigma coefficients for Hungary as well as the one for the Polish equity market, which were not unambiguously falling during the pre-crisis period. According to this analysis, and by comparison with the other countries under review, the level of convergence of the Czech financial markets was the most advanced. The highest level of integration was achieved by the foreign exchange market, followed by the equity and government bond markets. The lowest level of integration was attained just before the crisis broke out by the money market (as in the UK and Sweden).<sup>16</sup> However, the money market reached its highest level of integration immediately after the Czech Republic joined the EU and subsequently started to diverge slightly, unlike the Polish and Hungarian money markets.

TABLE 1

#### BETA COEFFICIENTS (SPEED OF CONVERGENCE)

	Government bond market			Equity market		
	99–7/07	8/07–4/09	5/09–01/10	99–7/07	8/07–4/09	5/09–01/10
CZ	-0.78	-0.78	-1.48	-0.83	-0.89	-0.88
HU	-0.82	-0.58	-0.96	-0.94	-1.34	-1.06
PL	-0.85	-0.83	-1.05	-0.95	-0.89	-0.90
SE	-0.89	-1.18	-0.70	-0.92	-0.75	-0.85
UK	-0.85	-0.86	-0.85	-0.85	-0.94	-0.97

	Foreign exchange market			Money market		
	99–7/07	8/07–4/09	5/09–01/10	99–7/07	8/07–4/09	5/09–01/10
CZ	-0.89	-0.86	-1.27	-0.69	-0.40	-0.74
HU	-0.88	-0.89	-1.22	-0.82	-0.76	-0.62
PL	-0.87	-0.92	-0.94	-0.67	-0.38	-0.28
SE	-0.97	-0.79	-0.78	-0.64	-0.93	-1.02
UK	-0.83	-0.92	-0.99	-0.75	-0.84	-0.59

Note: CZ – Czech Republic, HU – Hungary, PL – Poland, SE – Sweden, UK – United Kingdom. Estimates are statistically significant at the 1% level. Euro area assets were used as the benchmark for the money market (3M interbank rates), the foreign exchange market (exchange rates against USD) and the equity market (main national equity indices), while the German asset was used as the benchmark for the government bond market (yields on 5Y benchmark bonds).

Source: Thomson Reuters, CNB calculation.

<sup>14</sup> Asset prices are monitored at the aggregate level. It is assumed that the benchmark asset reacts only to global news.

<sup>15</sup> In the case of the equity market, strong convergence can be seen from the moment the bubble burst in the U.S. equity markets in 2002 (the dot-com bubble).

<sup>16</sup> The analysis indicates to some extent that regardless of period type the money market – at least in the cases of the Czech Republic, Sweden and the UK – is autonomous, with a strong local factor effect in the form of national monetary policy.

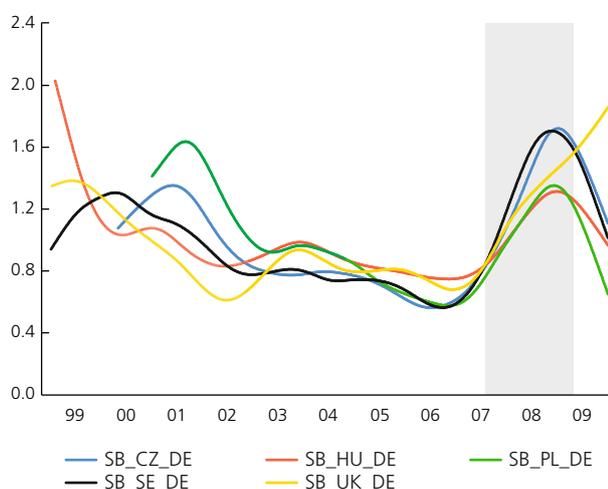
The news-based convergence analysis indicates that in the pre-crisis period the financial markets of the UK and Sweden achieved the highest level of integration on average (see Chart 2). Their government bond and equity markets in particular reacted to similar factors as the benchmark markets. This analysis confirmed the results of the price-

based analysis, which indicated that in the pre-crisis period the Czech Republic achieved the highest degree of convergence in the case of the foreign exchange market and the lowest degree of convergence in the case of the money market, with the effect of local news (national monetary policy) prevailing, similarly as in Sweden.

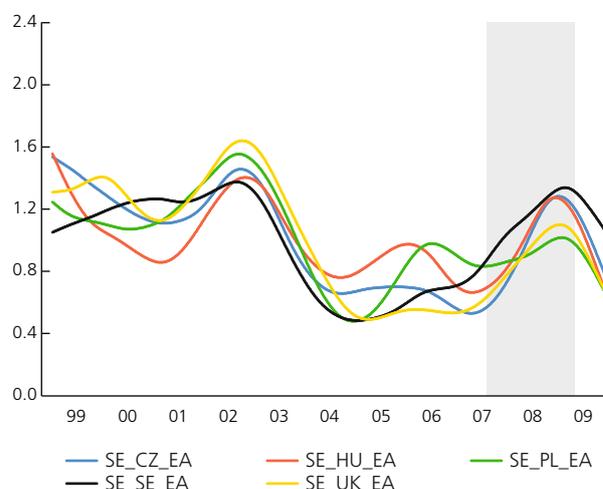
### CHART 1

#### SIGMA COEFFICIENTS (LEVEL OF CONVERGENCE)

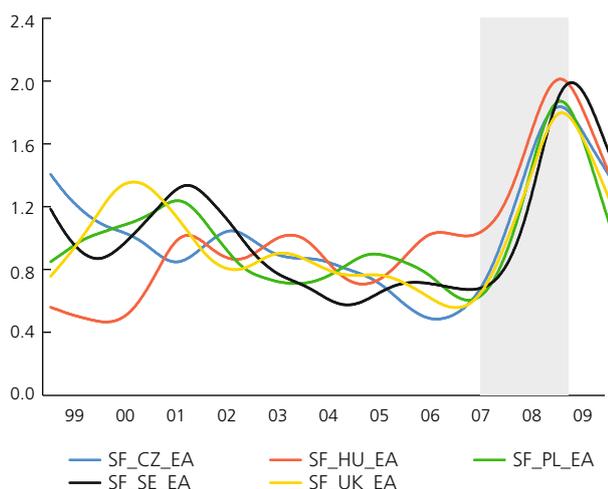
##### GOVERNMENT BOND MARKET



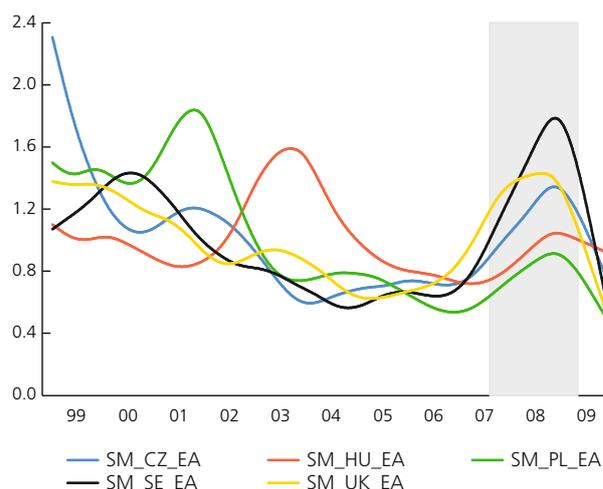
##### EQUITY MARKET



##### FOREIGN EXCHANGE MARKET



##### MONEY MARKET



Note: CZ – Czech Republic, HU – Hungary, PL – Poland, SE – Sweden, UK – United Kingdom, EA – euro area, S – sigma coefficient, B – government bond market, E – equity market, F – foreign exchange market, M – money market. The grey-shaded area indicates the core crisis period (August 2007–April 2009). The rate of correlation of the charts between the euro area and the USA ranges from 70% to 99%.

Source: Thomson Reuters, CNB calculation.

### Crisis period

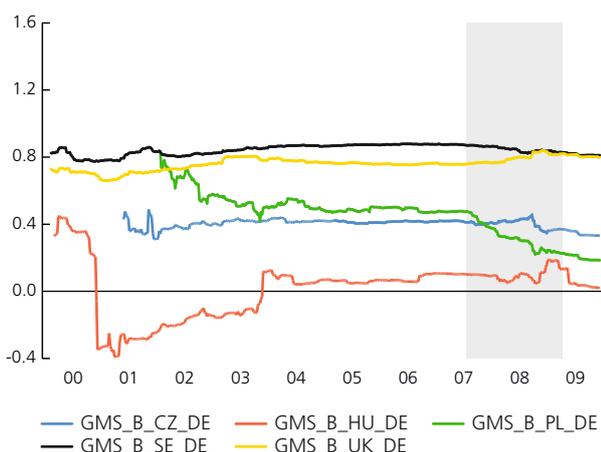
The ongoing financial crisis had a negative effect<sup>17</sup> on all the financial segments analysed in relation to the euro area, albeit with different intensity. The probably temporary, yet strong disintegration potential of the crisis is indicated most clearly by the results of the price-based approach (see Chart 1, grey-shaded area). This period can be characterised by increased nervousness among market participants and related increased volatility of market asset prices. Concerned about their liquidity positions, both investors and investment services intermediaries reined in their market activity, including

cross-border activity (growth in the home-bias effect, i.e. a preference for domestic assets) and thus weakened the integration process to a greater or lesser extent. This nervous behaviour and geographical discrimination, with more risky participants concentrating more on domestic markets, most affected the foreign exchange market and the government bond market (see Chart 1), as these markets started to diverge quite significantly and quickly. The convergence trend was regained only after central banks and governments adopted fundamental measures to reduce liquidity and credit risk. This led to a considerable decrease in the volatility of market asset prices (a decline in sigma coefficients).

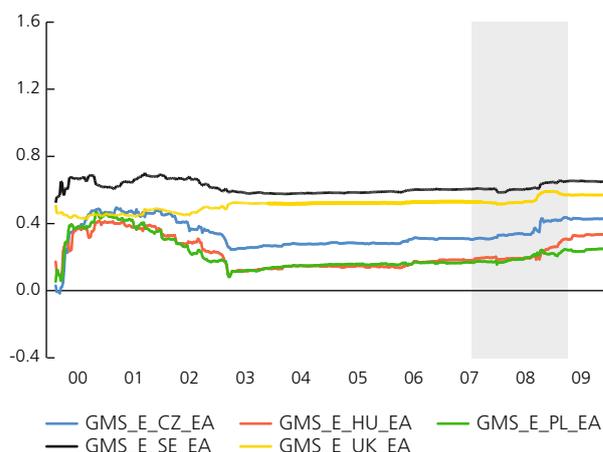
### CHART 2

#### GAMMA COEFFICIENTS (SENSITIVITY OF ASSET PRICES TO GLOBAL NEWS)

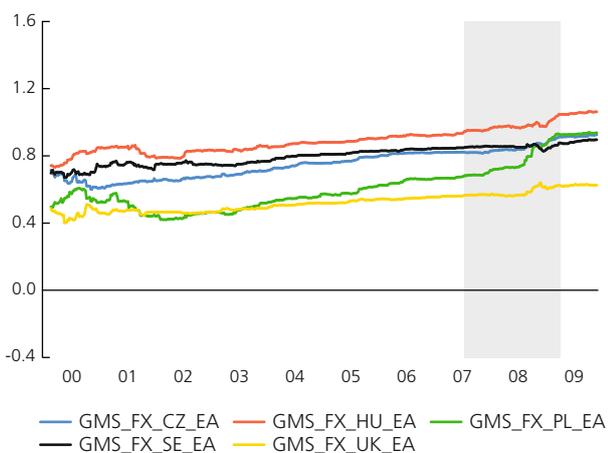
##### GOVERNMENT BOND MARKET



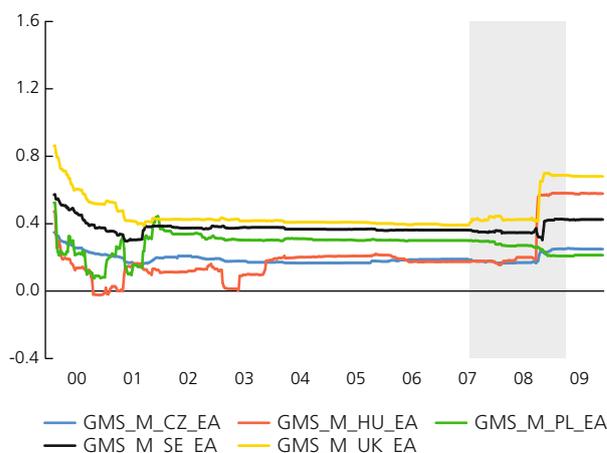
##### EQUITY MARKET



##### FOREIGN EXCHANGE MARKET



##### MONEY MARKET



Note: CZ – Czech Republic, HU – Hungary, PL – Poland, SE – Sweden, UK – United Kingdom, EA – euro area, GMS – gamma coefficient, B – government bond market, E – equity market, FX – foreign exchange market, M – money market. Positive (negative) and increasing (decreasing) gammas indicate co-directional (counter-directional) sensitivity to news, and values close to zero indicate indifference. The grey-shaded area indicates the core crisis period (August 2007–April 2009).

Source: Thomson Reuters, CNB calculation.

<sup>17</sup> Similar estimates were conducted symmetrically for the USA as the benchmark territory. The results were not very far from those of the selected countries vis-à-vis the euro area presented here. This indirectly suggests strong integration of the euro area and US markets

By contrast, the results of the news-based approach indicated that the integration of the financial markets (except for the Polish and Hungarian government bond markets) of the countries under review did not decrease (see Chart 2); in fact, it increased continuously in the case of the equity market. The simple conclusion of this approach might therefore be that financial instability simply does not affect the level of financial integration of the countries under review, or conversely increases it. However, the aforementioned results of the price-based approach (beta and sigma coefficients) indicated that the interpretation of this seeming paradox may be more complex.

The benchmark financial markets reacted to news coming in during the core crisis period (strong risk aversion, pooling of liquidity, high counterparty risk, etc.) almost exclusively negatively (with a declining trend). It is apparent from the stability/growth of the gamma coefficient that the financial markets of the countries under review also reacted to the same news. This may have been due to economic and asset integration between them and the benchmark territory.<sup>18</sup> Also significant, however, is the intensity with which the markets reacted, or rather the differences in the growth in volatility between individual market prices (a rise in the sigma coefficient and a fall in the beta coefficient). The different intensity of response of the individual markets to common (global) factors can be explained by, for example, the change in the composition of market participants at the time of the crisis, the different levels of development of the individual markets and by a preference for diversifying total portfolio risk across countries (Brooks and Del Negro, 2002) rather than across sectors.

### The calm-down period

As indicated above, the measures adopted by some central banks and governments, especially in late 2008 and spring 2009, generated optimistic expectations and a general calm-down in the financial markets. With few exceptions, the coefficients we are studying (sigma, beta and gamma) improved. The money market reacted relatively intensively to these measures (see Chart 1, except Hungary), especially in the cases of Sweden and the UK, and quickly lost its originally high sigma values. The gamma coefficients (see Chart 2) also clearly show the money markets' response

to the authorities' measures, which, especially in the case of the ECB, were not merely local in nature. A relatively small impact and a weak, or opposite, reaction to common news by the money market can be observed for Poland. An increased reaction to global news is also visible in the equity market. The reaction in the government bond market differs across countries. In the cases of the Czech Republic and Poland, local news starts to prevail in the government bond market and negative global shocks are transmitted to a decreasing extent. In the cases of Sweden and the UK, European news still prevails (high gamma coefficients). However, a still rising sigma coefficient for the UK suggests that even though the yields on UK government debt are highly sensitive to European news, the intensity of reaction of these yields is getting more and more distant from the intensity of reaction of Germany debt yields. In the case of Hungary's national debt, the coefficient for the rate of transmission of global news is still low, reflecting strong domestic shocks overshadowing European shocks (increased risk aversion). In the foreign exchange market the convergence trend is returning only slowly (see Chart 1). Except in case of the UK, however, the significance of European news is constantly rising, and in the case of Poland it has actually strengthened since the world authorities introduced their measures. Although this empirical analysis shows that the financial market situation is generally returning to an integration trend and major European news is more or less common to the countries under review, the commonly used indicators of market conditions reveal that the impact of the current crisis on the financial markets has not necessarily fully faded yet.

## 4. CONCLUSIONS

This article analysed the financial integration process primarily at times of financial (in)stability. It showed that financial integration and financial (in)stability are interconnected processes; increasing financial integration does not necessarily lead to financial (in)stability and financial (in)stability does not necessarily lead in the long term to financial market segmentation. In the past few years, financial integration has been stimulated by the development and implementation of financial innovations, whose incautious use – especially in the developed nations – contributed to the recent financial crisis. Assessments of

<sup>18</sup> Investors are susceptible to herd behaviour at times of major market turbulence caused by the reactions of over-sensitive investors (fed constantly by pessimistic economic forecasts for the integrated region). This behaviour usually amplifies similar trends in seemingly different markets and can be a source of financial contagion. In the extreme case, herd behaviour can result in a financial market reacting to global news that does not relate directly to that market.

the experience of the ongoing financial crisis have further modified perceptions about the integrated market. The importance of integration across segments of the financial market (integration between the foreign exchange, money, bond and equity markets) is now being emphasised, while the accent on separate examination of integration from the geographical perspective in the national market (e.g. the relationship between the Czech and European equity markets) is being suppressed. Given the experience of the unwinding financial crisis, therefore, the previously underestimated link between integration of individual financial market segments seems to be the cardinal condition for financial integration between countries.

The empirical analysis – based on the price-based and news-based methods – revealed that: (i) a process of increasing financial integration has been going on steadily in the Czech Republic since the end of the 1990s; (ii) the financial crisis caused temporary price divergence of the Czech financial market from the markets of the euro area (in the cases of the equity, money and foreign exchange markets) and Germany (in the case of the government bond market); (iii) results similar to those for the Czech Republic were generally obtained for the other selected inflation-targeting countries; (iv) the overall consequences of the financial crisis for financial stability were not significant in the Czech Republic, thanks mainly to restraint in the use of financial innovations and to the general soundness and prudent behaviour of Czech financial institutions.

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