

# Lóránt Varga: Hungarian sovereign credit risk premium in international comparison during the financial crisis

*As the CDS market has been the primary market for the price discovery of Hungarian sovereign credit risk in recent years, we can gain the most reliable information about Hungarian sovereign credit risk premia by analysing the price of Hungarian CDS contracts, in other words, the CDS spread. Credit default swaps are contractual agreements between two parties, whereby one party assumes the credit risk associated with a bond held by another party by undertaking to pay the other party the nominal value of the bond in the case that the issuer of the bond defaults, in exchange for which it receives a series of periodic payments from the other party during the term of the contract. The turnover and outstanding amount of CDS contracts related to Hungarian sovereign foreign currency bonds exceed the secondary market turnover and outstanding stock of Hungarian foreign currency bonds. Last autumn, Hungary was hit particularly hard by the significant decline in risk appetite observed in relation to emerging markets, and in October 2008 both the level and the relative international position of the Hungarian sovereign credit risk spread deteriorated substantially. Raising the key policy rate in October 2008, combined with the IMF credit facility, contributed largely to stopping the profound loss of confidence in Hungarian investment opportunities. The substantial decline in Hungarian sovereign CDS spreads observed in March-May 2009 can be almost entirely attributed to improving global risk appetite.*

## INTRODUCTION

The deepening of the global financial crisis in the autumn of 2008 was accompanied by a drastic decline in global risk appetite combined with a general, substantial increase in credit risk premia. Consequently, the Hungarian sovereign credit spread – the compensation which investors expect to receive in exchange for assuming the credit risk associated with Hungary – has also been higher in recent months than in previous periods. However, given that the various prices indicating new developments in the Hungarian sovereign credit spread have, to a certain degree, departed from one another during the period under review, defining the actual value of the Hungarian credit spread is currently a challenge in its own right. Along with identifying the precise changes that the credit spread has been subject to, another important issue is to determine the extent to which the growth in the spread can be attributed to a global decline in risk appetite – which equally affected all emerging markets – and to unique, country-specific factors. This article is intended to answer these questions.

The first part of the paper presents the alternative price data that capture developments in the Hungarian sovereign credit risk spread; the Hungarian sovereign foreign currency bond spread; and the Hungarian sovereign CDS – credit default swap – spread. Because of their relative unfamiliarity and ostensible complexity, we provide a detailed account of the characteristics of credit derivatives

and CDS contracts, as well as the functioning of the CDS market in general, and the Hungarian sovereign CDS market in particular. The next section contains a brief description of the findings based on which the CDS market, rather than the Hungarian sovereign foreign currency bond market, should be considered the most reliable measure of the Hungarian sovereign credit spread. The last section of the paper proceeds to identify the global and country-specific factors which have contributed to the changes in the Hungarian credit spread in recent months.

## MEASURING THE SOVEREIGN CREDIT RISK OF HUNGARY

Several sources are available to provide information on developments affecting Hungarian sovereign credit risk. For example, we can monitor the assessment of major international credit rating agencies (Moody's, S&P, Fitch, etc.) of Hungary's credit rating as well as their revisions of Hungary's rating. While these ratings are typically reliable indicators of changes in the credit risk associated with a country in the long run, the credit ratings of individual rating agencies may differ from one another in the short term, and the decision to upgrade or downgrade a certain country often lags behind market perceptions. For this reason, in order to analyse the changes in Hungary's sovereign credit risk with higher frequency – for example, on a daily basis – we must seek a different source of information. The accuracy of the information can also be improved by relying on price data

obtained from financial markets, which reflect the actual financial investments of market agents.

One possible solution is to quantify the exact portion of the yield on *Hungarian foreign currency bonds*, which investors expect to receive in exchange for assuming the credit risk associated with the Hungarian government. If investors' perception of Hungary's sovereign credit risk changes, the credit spread they expect to receive will increase or decrease accordingly. The credit spread on a euro-denominated Hungarian foreign currency bond can be estimated by deducting from its yield the yield of a corresponding risk-free bond, the other parameters (maturity, denomination, interest rate, secondary market liquidity, etc.) of which are completely identical with the first bond. Since all parameters of the two bonds – other than credit risk – are identical, we can assume that their yields contain the same amount of other (interest rate, liquidity, exchange rate, reinvestment, etc.) risk premium, and thus any difference between the two yields should purely reflect the credit spread associated with the Hungarian foreign exchange bond. In line with the prevailing market practice, for the purposes of this paper we used the euro-denominated German government bond yield to approximate the value of the risk-free euro yield. However, our estimate of the yield spread on Hungarian foreign currency bonds may not be entirely accurate, due to the following reasons: one, even German government bonds are not completely risk-free; two, Hungarian and German foreign currency bonds cannot have precisely identical parameters; three, the liquidity of the Hungarian foreign currency market is much lower than that of the German government bond market. Consequently, Hungarian foreign currency bond yields should definitely contain a higher liquidity premium. Nevertheless, some of these imperfections can be eliminated, and empirical experiences suggest that the overall distortion they create is not as significant as to render analyses based on the thus estimated yield spreads unreliable.

Thanks to the development of financial markets, by the middle of the 2000s an alternative source of determining the price of Hungarian sovereign credit risk emerged: the price of *credit default swap (CDS) deals*, a derivative product used explicitly for the pricing and transferring of credit risk.

## CDS CONTRACTS AND THE HUNGARIAN SOVEREIGN CDS MARKET

Considering their success and steady development, *credit derivative products* are by far the most prominent financial innovation of the last decade. A common feature of these

financial contracts is that they are used to transfer the credit risks associated with bonds or loans from one party to another without transferring any other risks (such as exchange rate, interest rate, reinvestment risks, etc.) associated with these loans or bonds. The borrower or the issuer of the bond does not typically participate in the deal, which is made between two counterparties independently of the borrower or issuer.

*Credit default swap (CDS)* contracts constitute the basis for credit derivative markets. According to the semi-annual survey conducted by BIS in the derivative market (2008) and to the data provided by ISDA (2008), at the end of 2007 the total nominal value of outstanding CDS contracts reached USD 30 trillion. Credit default swaps are contractual agreements made between two parties for a pre-determined term, in order to transfer the credit risk associated with a third party (the entity that issued the bond or the borrower, hereinafter the reference entity) from one party to the other. The term CDS refers to this credit risk swap. However, when we look at the functioning of these contracts and the pattern of the related cash flow, we find that CDS transactions are in fact much closer to insurance or option deals in content than to traditional *swap* transactions.<sup>1</sup>

According to market terminology, the buyer of the CDS buys protection, while the seller of the CDS is obligated to compensate the protection buyer by paying the nominal value of the bond or the loan if the reference entity defaults. The protection buyer makes a series of periodic payments to the protection seller, and does not realise a profit on the deal unless the reference entity defaults or the market's collective assessment of the credit rating of the reference entity deteriorates during the term of the CDS. By contrast, the protection seller receives periodic payments, and profits from the deal if no default takes place during the term of the CDS, or the credit rating of the reference entity improves. The CDS buyer or seller can take advantage of the deterioration or improvement of the reference entity's credit rating if – rather than locking in their positions until maturity – they enter into an offsetting contract to close the deal as soon as the prevailing fees change to their advantage. In this case, the profit they realise will be the difference between the fees collected on the two opposing deals.

The regularly paid fee is commonly known as the *CDS spread* in international terminology. The term 'spread' usually refers to a type of interest rate margin or interest rate premium. On the one hand, the premium paid regularly under CDS contracts is called a spread because its amount is determined in basis points. The regularly paid premium is the product of

<sup>1</sup> See Csávás–Varga–Balogh (2007) for details on the characteristic features and classification of traditional swap transactions.

this amount defined in basis points and the total nominal value of the underlying bonds or loans of the CDS contract between the parties. On the other hand, we may look at the regularly paid premium as a portion of the regular interest income paid by the reference entity to the party holding the bond or loan instrument, which the latter passes on to the protection seller in exchange for the seller's assumption of the credit risk associated with the reference entity. Thus, in this sense, the regularly paid premium is a portion of the received interest payable in exchange for taking on credit exposure (credit risk premium).

There are two major groups of *driving forces* behind participation in CDS contracts (and essentially in any other credit derivative transaction). First, by means of CDS deals the credit risk associated with the holding of loan or bond portfolios can be reduced or completely eliminated. Second, the application of credit derivatives allows the investor to take up and switch positions easily and flexibly, betting on positive or negative future changes in the creditworthiness of an economic agent. To achieve this latter goal, it is not even necessary for the investor taking up a position in the credit derivative market to have any exposure vis-à-vis the specific economic agent. Speculating on changes in an entity's creditworthiness and taking up positions accordingly has substantially contributed to the surge in credit derivatives in recent years, as credit derivatives allow investors to take such positions with an ease and flexibility that would not be possible by means of the underlying loan or bond instruments alone.

Based on the sector of reference entities, global CDS markets can be divided into two major groups: CDS markets linked to corporate bonds (including bank-issued bonds) and sovereign bonds. CDS deals with underlying corporate bonds are by far the more dominant of the two. Even though recent years have seen a considerable turnover growth in *sovereign CDS deals* – as has been the case in the global market overall – data provided by the large credit derivative brokers which we interviewed indicate that their market share is only around 5-6%, and the nominal value of outstanding sovereign CDS contracts was probably around USD 1.5-1.8 trillion at the end of 2007. CDS contracts with the underlying foreign currency bonds of emerging countries accounted for the vast majority of sovereign CDS turnover, representing over 90%.

Most features of sovereign CDS deals are identical with those of corporate bonds except, naturally, that under a sovereign CDS contract it is a country's credit risk that is transferred between market participants. A sovereign CDS contract may have any maturity. However, the most favourable terms are between 1 and 10 years, of which the

5-year-term tends to be the most liquid according to market participants. In case of a default event on the part of the specific sovereign reference entity (typically a failure to pay, debt restructuring or moratorium), the protection buyer delivers to the protection seller any bond under the terms of the contract issued by the reference entity in the face value equal to the nominal value specified in the CDS, in return for which the protection seller pays the buyer the par value of the bond. Rather than physically delivering the bonds affected by the default event, using a cash settlement for the conclusion of CDS contracts has become an increasingly popular practice in sovereign CDS markets. In this case, the protection buyer does not have to deliver the bonds; instead, the protection seller pays the buyer the difference between the par value and the post-default market value of the affected bonds. Under the terms of sovereign CDS contracts, in the case of a default event, government bonds issued by the specific sovereign can be generally delivered denominated in any accepted foreign currency listed in the ISDA Master Agreement (euro, US dollar, pound sterling, Japanese yen, Swiss franc, and Canadian dollar). In sovereign CDS trades, the CDS spread is also quoted as an annual premium payable by the protection buyer, but as is the case in other CDS markets, it is typically paid in quarterly instalments, and the nominal amount of the payment is the specific par value multiplied by the specific portion of the CDS spread computed for the length of the given quarter (length of the quarter in days/360).

Under Hungarian sovereign CDS contracts, the counterparties can transfer the credit risks of foreign currency bonds issued by the Hungarian government denominated in any standard, accepted foreign currency. Reliable information regarding the Hungarian sovereign CDS market is scarce. Similarly to other credit derivatives markets, the Hungarian sovereign CDS market is a typical OTC (over-the-counter, unregulated) market where the scope of market participants and their trading motives are hard to grasp. There are no real dealers; trading takes place through credit derivative brokers, who are responsible for pairing up the anonymous, nevertheless binding bids of market participants, typically submitted by electronic mail. The majority of credit derivative brokers are based in London or New York. According to the triennial BIS survey on global foreign currency and derivatives market activity (2007) and based on the information provided by domestic credit institutions, Hungarian market participants do not enter into Hungarian sovereign CDS contracts. Active market participants include global investment banks, hedge funds and other non-resident fund managers, typically motivated by the possibility of taking flexible positions, which allows them to take advantage of any changes in the credit risk premium of the Hungarian government. Trading is based on the terms of the ISDA Master Agreement, a standard form

widely used in credit derivatives markets; price quotes typically refer to nominal values of EUR 5-10 million. In line with global trends, contracts with a 5-year maturity are the most liquid in the Hungarian sovereign CDS market as well. According to the information provided by credit derivative brokers, the Hungarian sovereign CDS market achieved an adequate level of liquidity around the end of 2005 and early 2006, which marked the beginning of a gradual turnover growth; particularly remarkable liquidity growth was observed from early 2008.

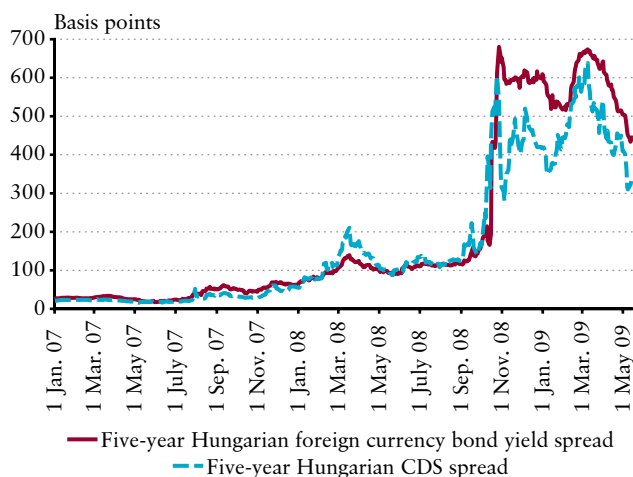
Based on the survey we conducted in 2008 with the participation of the largest global credit derivative brokers (see Varga, 2008), the Hungarian sovereign CDS market has low liquidity compared to the average liquidity of credit derivatives markets. In terms of the number of quotes it is in the lowest quarter of sovereign CDS markets. Nevertheless, *in 2008 brokers typically received 30-40 binding price quotes on a daily basis from an average of ten banks*, accounting for 1-3% of all sovereign CDS quotes, while the daily turnover of actual trades is estimated to be at least EUR 10-20 million. While these values significantly fall behind the turnover of the most liquid CDS markets, the Hungarian sovereign CDS market is considerably more liquid than the secondary market of the underlying Hungarian sovereign foreign currency bonds, where no daily trades are performed according to market participants. Based on our estimate, *the outstanding stock of Hungarian sovereign CDS contracts at the end of 2007 amounted to around USD 10-30 billion or around EUR 7-20 billion*. Based on the CDS stock data published following our survey<sup>2</sup> by the clearing house *Depository Trust & Clearing Corporation (DTCC)* at the end of October 2008, the above estimate – particularly its upper limit – was in the correct range. According to the information provided by DTCC, on 31 October 2008 the gross outstanding stock of Hungarian sovereign CDS contracts amounted to nearly USD 33 billion, or over EUR 25 billion. Comparing these values to USD 21 billion – the total amount outstanding of foreign currency bonds issued by the Hungarian government as of the end of 2007 – it is evident that despite its daily turnover falling far short of the average turnover of the more liquid credit derivatives markets, the Hungarian sovereign CDS market should still be considered a significant market from the perspective of pricing Hungarian sovereign credit risk.

## PRIMARY MARKET OF THE PRICE DISCOVERY OF HUNGARY'S SOVEREIGN CREDIT RISK

As the previous section indicated, the price of Hungary's sovereign credit risk can be defined both as the Hungarian sovereign foreign currency bond yield spread over the corresponding risk-free bond yields, or as the CDS spread. If these two prices are the same, we can rely equally on either one and draw the same conclusion, in other words, the price discovery that took place in two different markets will not pose a problem. If the opposite is true, i.e. the two prices are not identical, in order to achieve a reliable analysis, as a first step we need to decide which price provides more – as well as more accurate – information about the changes in the credit spread.

Chart 1

### Developments in the five-year Hungarian CDS spread and the five-year Hungarian foreign currency bond yield spread<sup>3</sup>



Source: Datastream, Bloomberg, own calculations.

Until the final quarter of 2007, the two five-year Hungarian sovereign credit spreads moved together; fluctuating around 20-30 basis points (see Chart 1). However, from the end of 2007 they deviated from one another several times. Initially, in 2008 the CDS spread was typically higher than the foreign currency bond yield spread, but at the end of 2008 they reversed directions. While both the CDS spread and the bond yield spread started to soar, the difference between them

<sup>2</sup> <http://www.dtcc.com/products/derivserv/data/index.php>.

<sup>3</sup> On the computation of five-year Hungarian sovereign foreign currency bond yield spreads, see Varga (2008). In view of the fact that credit spreads were subject to a significant increase in the autumn of 2008 even in countries previously considered risk-free – including Germany – we deviated from the method applied for the purposes of that study in that we deducted the prevailing German CDS spread from the euro-denominated benchmark German government bond yield in order to calculate the risk-free yield.

increased significantly as well, at times reaching or even exceeding 200 basis points, and in any case, staying consistently over 100 basis points. Cointegration analyses examining the relationship between the two time series over different periods arrived at similar conclusions.<sup>4</sup> They confirm that while the two time series cointegrate in the long run, they may temporarily deviate from one another due to microstructural factors (for example, the different liquidity situation of the two markets, the small proportion of participants that are active in both markets, transaction costs, which are capable of persistently preventing market arbitrage forces from coming into effect). Thus, the Hungarian CDS spread and the foreign currency bond yield spread may contain strongly conflicting information about the changes in the credit spread in different periods, and therefore we need to decide which of the two has the most reliable information content.

In the case of financial markets, the concept of market effectiveness can be used to determine how relevant and reliable the information content of market pricing is. To put it simply, the more available information is captured in the prices of a market, the faster, the more effective the given market should be. On the other hand, the more liquid a financial market is, the information is captured in the prices to a greater extent and faster. Consequently, of two markets sharing the same parameters, the more liquid one is probably more effective. Despite the lack of precisely verifiable data, we have suggested before that according to information obtained from market participants, the Hungarian sovereign CDS market is more liquid than the secondary market of Hungarian sovereign foreign currency bond market. Based on this, the CDS market is probably the more effective market of the two, in other words, the CDS spreads contain more relevant information about the developments in the Hungarian sovereign credit risk.

Furthermore, effective markets tend to be the first to capture changes in prices, while price changes in the less effective, albeit similar markets, will lag behind. This further supports our assumption that the CDS market is more effective than the foreign currency bond market. Indeed, as Chart 1 clearly indicates, in recent years the five-year foreign currency bond yield spread has typically adjusted to changes in the five-year CDS spread with a lag. To put it differently: Chart 1 suggests that the CDS market, rather than the foreign currency bond market, is the primary market where the price discovery of the Hungarian sovereign credit spread takes place, as new

information regarding the credit spread is first captured in the CDS spreads.

However, anecdotal information obtained from market participants and the correlation suggested by the chart should not be considered irrefutable evidence. Thus, as it is suitable in the case of cointegrating time series, we have conducted a number of error correction analyses for the purpose of identifying the primary market of price discovery.<sup>5</sup> Based on the results, for the periods of both 2006–2008 and 2008–2009 *the CDS market was undoubtedly the primary market of the price discovery of the Hungarian sovereign credit spread*, while the foreign currency bond market did not prove to be an effective market, in that the foreign currency bond yield spread merely adjusted to changes in CDS spreads. As we have seen, an analysis of Hungarian CDS spreads can provide the most accurate information about the Hungarian sovereign credit spread. This result characterises countries other than Hungary as well: in the majority of emerging countries examined in 2008 by Varga (2008), the CDS market, rather than the foreign currency bond market, was the leader in the price discovery process of the sovereign credit spread. Consequently, including the period that has elapsed in 2009 to date, the CDS spread was a more reliable measure of the actual level of the sovereign credit spread, which also implies that the foreign currency bond yield spread – which exceeds the CDS spread by an average of 100–200 basis points according to Chart 1 – should not be considered realistic as a *credit spread*. Nevertheless, we cannot conclude that the level of Hungarian sovereign foreign currency bond yields is unjustified from an *economic perspective*. Indeed, the fact that the foreign currency bond yield spread has been persistently higher than the CDS spread probably reflects a significant increase in the level of the liquidity premium on Hungarian foreign currency bonds since late October 2008. As we have stated above, the method we applied to estimate the credit spread of foreign currency bond yields cannot separate the liquidity premium from the foreign currency bond yield spread.

## DEVELOPMENTS IN HUNGARIAN SOVEREIGN CDS SPREADS IN INTERNATIONAL COMPARISON

As Chart 1 indicates, the CDS spread, a reliable measure of the Hungarian sovereign credit spread, increased slightly in March–April 2008, and significantly in the autumn of 2008. In the rest of this paper, our primary goal is to assess the

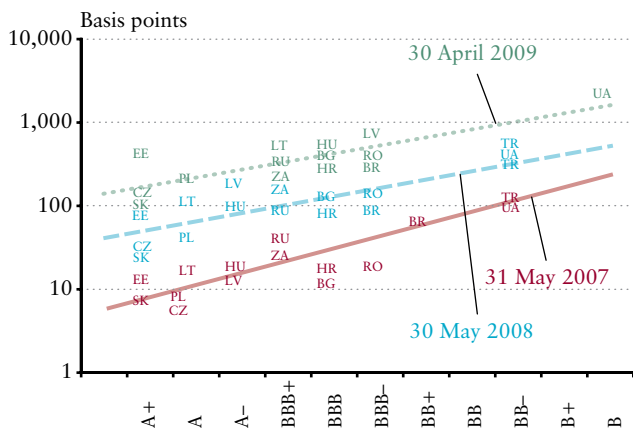
<sup>4</sup> The exact method and the results of the periods preceding 2008 are presented in Varga (2008), while the results of the period between 2008 and 2009 are included in the Annex.

<sup>5</sup> The exact method and the results of the periods preceding 2008 are presented in Varga (2008), while the results of the period between 2008 and 2009 are included in the Annex.

**Chart 2**

**Credit ratings and five-year CDS spreads of emerging countries**

(on a logarithmic scale, on specific days)



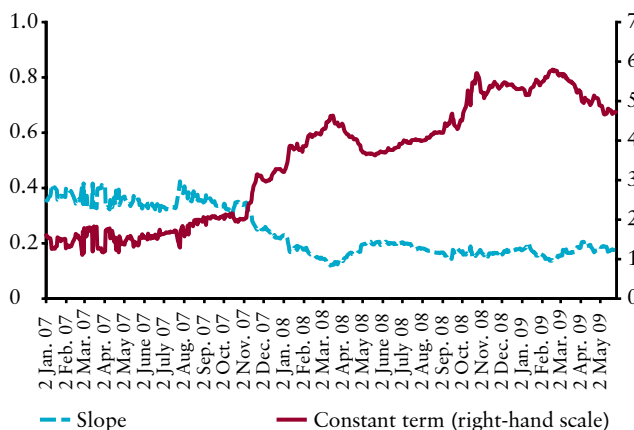
Source: Datastream, own calculations.

extent to which the above changes in the Hungarian credit spread can be attributed to a substantial, global decline in risk appetite observed in the second half of 2008 – i.e. a general increase in global credit spreads – and the extent to which country-specific factors contributed to these developments. To answer this question, we conducted a comparative analysis of the five-year Hungarian sovereign CDS spreads versus CDS spreads observed in different other countries in the period of January 2007 and May 2009, taking into account the credit ratings of the sample countries as well. Besides Hungary, we used the 5-year CDS spreads and the average credit rating – the average rating of Moody’s and S&P – of 14 additional emerging countries<sup>6</sup> relevant from the perspective of the relative development of the Hungarian economy and Hungarian financial markets for our calculations.

Our goal was to grasp, at each point in time across the sample period, the common information we can gain from the relationship between the CDS spread and credit ratings of different emerging countries, and examine how the specific values of Hungary compare to that common information. In order to achieve this – in the same way as illustrated by the three randomly selected days on Chart 2 – we estimated a regression for each day of the sample period between the

**Chart 3**

**Daily changes of the slope and the constant term of the linear regression between the credit ratings and the logarithms of five-year CDS spreads of emerging countries**



Source: Own calculations.

five-year CDS spreads and the credit ratings of the emerging countries in our sample.<sup>7</sup>

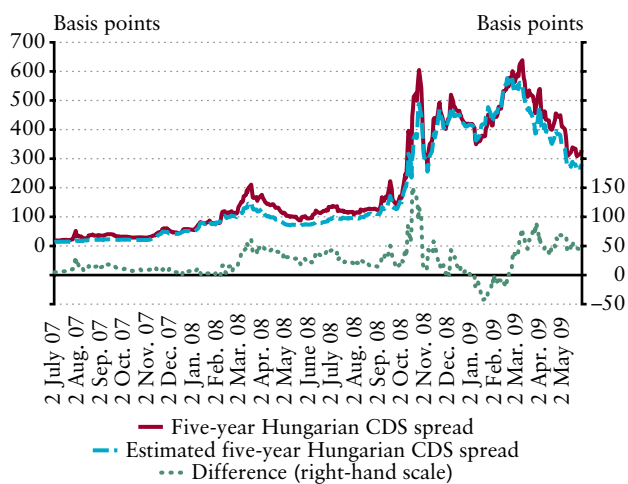
The slope of the daily regression lines was positive across the sample period (Chart 3).<sup>8</sup> This means that the five-year sovereign CDS spread levels of the emerging countries in our sample were broadly consistent with the credit rating of individual countries, as the expected CDS spread of lower-rated countries is wider than that of countries with a better credit rating. The slope of the regression lines remained steady until the end of 2007; however, from the end of 2007 the slope began to flatten and the constant term of the regressions began to rise. Since – in consideration of the non-linear relationship between credit quality and the expected credit spread – we ran the regression on the logarithm of CDS spreads, this change indicates an overall, significant widening of credit spreads across all credit rating categories from the end of 2007, which further escalated in the autumn of 2008.

As regards Hungary, based on the parameters of the daily regressions between the credit ratings and five-year CDS spreads of emerging countries, we estimated what would have been the value of the five-year Hungarian sovereign

<sup>6</sup> Brazil, Bulgaria, Croatia, the Czech Republic, Estonia, Latvia, Lithuania, Poland, the Republic of South Africa, Romania, Russia, Slovakia, Turkey and Ukraine.

<sup>7</sup> For a more detailed description of the method, see Varga (2008). While regression analysis is in theory used to examine the relationship between two ratio variables, general market experience suggests a linear relationship between the logarithms of credit spreads and the credit ratings measured on an ordinal scale. We used the logarithm of credit spreads because according to general market experience, the change in credit spreads that follows the deterioration of the credit rating between categories is usually not linear but exponential, as market participants demand increasing expansion in risk premia when credit quality declines, especially as the credit rating approaches non-investment grade categories.

<sup>8</sup> On 13 March 2008 the slope of the estimated regression line reached 0.12, its flattest position in the sample period, however, with a p value of 0.009 even this figure implies a statistically significant positive slope at all standard significance levels.

**Chart 4**
**Deviation of the five-year Hungarian CDS spread from the regression line between the credit ratings and five-year CDS spreads of emerging countries**


Source: Datastream, own calculations.

CDS spread on each day of the sample period (see Chart 4). While the estimated and actual values of the CDS spreads broadly cointegrated during the sample period, from 2007 we could identify three periods when the actual value of the CDS spread exceeded – by more than 50 basis points – the regression line between the credit ratings and five-year CDS spreads of emerging countries. Thus in these periods (in March 2008, in October 2008 and starting from March 2009) the value of the Hungarian sovereign CDS spread was not consistent with the correlation we observed between the sovereign credit ratings and the level of sovereign CDS spreads across the group of emerging countries.

The increase of the Hungarian sovereign CDS spread to 150 basis points in *March 2008* was justified by the overall surge observed in the CDS spreads of emerging countries across all credit rating categories. However, exceeding this value of 150 basis points – which was justified by global developments – by around 60 basis points, the Hungarian sovereign CDS spread increased to 210 basis points. Thus, this 60-basis-point increase should be considered a country-specific factor, which cannot be attributed to the general growth of credit spreads observed in global markets. Although this country-specific growth in March 2008 was neither significant nor lasting, it was rather exceptional because, in addition to *fundamental reasons* (i.e. investors' more negative perceptions about the credit risk of Hungary than would have

been justified by the official assessment of credit rating agencies) *technical factors* contributed to it as well, as market participants reported a significant decline in the liquidity status of the secondary market of forint government securities and an increase in liquidity premia during the same period.<sup>9</sup>

Parallel to the gradually decreasing Hungarian sovereign CDS spread, the difference declined as well from April 2008, but even until late August it was unable to drop below 20 basis points for a longer period of time. This suggests that even after March 2008 investors had a slightly worse perception of Hungary's credit risk than the average of other emerging countries with similar credit rating. This assumption is supported by the fact that the growth of the Hungarian CDS spread following the default of Lehman Brothers in September 2008 surpassed the level justified by the general, global growths of CDS spreads, and the difference once again reached 50 basis points.

As the credit spread of emerging countries temporarily decreased after the default of Lehman Brothers, a significant decline in risk appetite was observed *in early October 2008*, indicating that the government and central bank measures announced in developed markets failed to alleviate investors' fears in the long run. Considering the average credit rating of Hungary at the time, until the middle of October global developments justified growth of the Hungarian CDS spread up to nearly 500 basis points, which is more than twice as high as the highest value observed in the past. At that point, it became apparent that investors' perceptions of the credit risk of Hungary was significantly more unfavourable than their assessment of the credit risk of other emerging countries. Indeed, on 16 October 2008 the Hungarian sovereign CDS spread surpassed the regression line between the credit ratings and five-year CDS spreads of emerging countries by 150 basis points, a historical high. *In conclusion, the significant decline in risk appetite triggered by the financial crisis, which affected all emerging markets, was particularly severe for Hungary*, because the perceptions of market participants of Hungary's credit risk was significantly poorer – by several rating categories – than its prevailing average credit rating. *The emergency interest rate increase on 22 October 2008 followed by the announcement of the IMF credit facility agreement on 26 October largely contributed to stopping the profound loss of confidence in Hungarian investments.* In the days that followed, parallel to a general global improvement of credit spreads, the difference between

<sup>9</sup> Indeed, investors who were unable to reduce their Hungarian credit risk exposure because the shrinking liquidity of the domestic government bond market did not allow them to sell their government bonds to the extent they had wished to suddenly created an immense demand for Hungarian sovereign CDS contracts. As they were seeking protection with respect to their credit exposure vis-à-vis the Hungarian government, their behaviour triggered an abrupt and substantial increase in the Hungarian CDS spread. For more details see Varga (2008).

the actual and the estimated Hungarian CDS spreads dropped to nearly zero from the previously observed historical high.

However, the decline of the Hungarian sovereign CDS spread proved to be temporary: as early as the middle of November 2008 its growth surpassed, once again, the extent justified by the regression line between the credit ratings and five-year CDS spreads of emerging countries. Although the difference, which exceeded 50 basis points again, returned close to zero by the end of November, this time the narrowing reflected the downgrading of Hungary's credit rating that was first announced by Moody's and then by S&P in November, rather than new developments that improved Hungary's risk perception. While the difference widened again in the first few days of December, between late November 2008 and late February 2009 the value of the Hungarian CDS spread was broadly consistent with the global changes in credit spreads. In fact, as evidenced by the negative difference between the actual and estimated CDS spreads, in January 2009 investors' perceptions regarding Hungary's credit risk was more positive than the average credit rating of the country at the time.

These positive developments came to a halt in *March 2009*, when – reflecting a substantial weakening of the forint exchange rate – the Hungarian sovereign CDS spread significantly surpassed the level justified by global developments once again. Fluctuating around 500 basis points, at the end of March the Hungarian CDS spread exceeded the level warranted by Hungary's prevailing credit rating by nearly 100 basis points. Again, the widening of the gap was halted by Moody's and S&P's announcement in the last days of March about further downgrading Hungary's credit rating, each by one category. However, contrary to November 2008, the gap between the actual and estimated Hungarian CDS spreads did not narrow to close to zero in the wake of the downgrades; in fact it continued to fluctuate at around 50 basis points until the end of May 2009 (the end of the sample period). *Thus, the substantial decline in Hungarian sovereign CDS spreads that exceeded 300 basis points in the period of March-May 2009 can be almost entirely attributed to improving global risk appetite*, rather than an improvement in Hungary's relative global credit risk position.

## CONCLUSIONS

The price of Hungary's sovereign credit risk can be defined both as the Hungarian sovereign foreign currency bond yield spread over the corresponding risk-free bond yields, or as the price of Hungarian sovereign CDS contracts, the CDS

spread. Credit default swaps are contractual agreements made between two parties for a pre-determined term to transfer the credit risk associated with the issuer of a bond. During the term of the CDS contract the party transferring the credit risk pays the protection seller a series of periodic payments, commonly known as the CDS spread. If the reference entity defaults, the protection seller will pay the protection buyer the nominal value of the bond. The turnover and outstanding amount of the CDS contracts related to Hungarian sovereign foreign currency bonds exceed the secondary market turnover and outstanding stock of Hungarian foreign currency bonds.

In recent years, the CDS market was undoubtedly the primary market of the price discovery of the Hungarian sovereign credit spread, while the foreign currency bond market did not prove to be an effective market, in that the foreign currency yield spread merely adjusted to changes in CDS spreads. Therefore, an analysis of Hungarian CDS spreads can provide the most accurate information about the Hungarian sovereign credit spread. In the period of 2009 that has elapsed to date, foreign currency bond yield spreads have been remarkably high, significantly exceeding the level of the CDS spread, probably reflecting the increased liquidity premium on Hungarian foreign currency bonds.

The beginning of October 2008 saw a dramatic increase in the credit spreads of emerging markets, and at the same time it became apparent that investors' perceptions of the credit risk of Hungary was significantly more unfavourable than their assessment of the credit risk of other emerging countries. Indeed, the extent to which the Hungarian sovereign CDS spread surpassed the level justified by global developments reached a historical high during this period. In conclusion, the significant decline in risk appetite triggered by the financial crisis, which affected all emerging markets, was particularly severe for Hungary, because the perceptions of market participants of Hungary's credit risk was significantly poorer – by several rating categories – than its prevailing average credit rating. The emergency interest rate increase on 22 October 2008 followed by the announcement of the IMF credit facility agreement on 26 October largely contributed to stopping the profound loss of confidence in Hungarian investments. In the days that followed, parallel to a general global improvement of credit spreads, the relative disadvantage of Hungary vis-à-vis other emerging countries diminished. In contrast, the substantial decline in Hungarian sovereign CDS spreads that exceeded 300 basis points in the period of March-May 2009 can be almost entirely attributed to improving global risk appetite, rather than an improvement in Hungary's relative global credit risk position.



**ANNEX**

**Long-term relationship between the Hungarian sovereign foreign currency bond market and the Hungarian sovereign CDS market, and the primary market of the price discovery of credit risk (2008–2009)**

Since the foreign currency bond yield spreads and CDS spreads subject to our examination tend to follow a unit root process, we applied a cointegration method to analyse the long-term relation between the two markets. To determine the contribution of each market to price discovery, we estimated the following vector error correction model:

$$\Delta p_{CDS,t} = \lambda_1 (p_{CDS,t-1} - \alpha - \beta p_{CS,t-1}) + \sum_{j=1}^p \gamma_{1j} \Delta p_{CDS,t-j} + \sum_{j=1}^p \delta_{1j} \Delta p_{CS,t-j} + \varepsilon_{1t} \quad (1a)$$

$$\Delta p_{CS,t} = \lambda_2 (p_{CS,t-1} - \alpha - \beta p_{CDS,t-1}) + \sum_{j=1}^p \gamma_{2j} \Delta p_{CDS,t-j} + \sum_{j=1}^p \delta_{2j} \Delta p_{CS,t-j} + \varepsilon_{2t} \quad (1b)$$

where  $p_{CDS,t}$  implies the sovereign CDS spread and  $p_{CS,t}$  implies the sovereign foreign currency bond yield spread at date  $t$ . The first, parenthetical expression on the right side of equations (1a)–(1b) implies the error correction mechanism through which the sovereign credit spread evolving in the two markets cointegrate in the long run. Parameters  $\alpha$  and  $\beta$  of the error correction coefficient are the equivalent of the cointegration parameters.<sup>10</sup> The cointegration and error correction analysis was performed by using the most liquid, five-year Hungarian CDS spreads and five-year Hungarian foreign currency yield spreads for the period of 2 January 2008–15 May 2009 (359 observations).

Based on the results of the Johansen cointegration analysis, there is evidence of cointegration between the five-year Hungarian sovereign CDS spread and the five-year Hungarian sovereign foreign currency bond yield spread in the sample period (At the 5% significance level, we reject the null hypothesis suggesting the opposite, as indicated by Table 1). On the other hand, based on the test statistics indicated in the second row, we also reject the null hypothesis of value [1, -1] for the cointegrating vector. As noted above, our results indicate that the Hungarian sovereign CDS spread and foreign currency bond yield spread cointegrate over the long run. However, the two prices may deviate from one another over the short term due to transaction costs, a difference in market liquidity and additional microstructural factors. Taking also into account the results suggested by Varga (2008), the cointegration parameter  $\beta$  exceeded 1 in the sample period 2006–2008, and dropped below 1 in 2008–2009. This implies that in 2006–2008 the CDS spread, while in 2008–2009 the foreign currency bond yield spread was more volatile.

As for the parameters of the error correction model, the value of parameter 2 was significantly positive in the sample period, while the value of parameter 1 was not significant. This means that in the sample period it was primarily in the Hungarian sovereign CDS market where the price discovery of Hungary’s credit spread took place, i.e. new information regarding the credit risk of Hungary was first captured in the CDS spreads. By contrast, the foreign currency bond market was not an effective market considering that foreign currency bond yield spreads merely followed the changes in CDS spreads. If we

**Table 1**  
**Estimation results**

	January 2008–May 2009
Null hypotheses	
No cointegration	33.59*
$\beta=1$	25.86*
Estimated $\beta$	0.80
$\lambda_1$	-0.005
$\lambda_2$	0.083*

Note: the first row of the table presents Johansen trace test statistics for the five-year Hungarian CDS spread and foreign currency bond yield spread. The number of lags in the underlying vector auto regression is defined by means of the Akaike Information Criterion (AIC). The second row displays test statistics for restrictions on the cointegration parameter  $\beta$ . The third row indicates the estimated value of parameter  $\beta$ . The fourth and fifth rows contain the estimated values of parameters  $\lambda_1$  and  $\lambda_2$  of equations (1a)–(1b).

For the null hypotheses displayed in the first two rows, the \* sign indicates the rejection of the specific null hypothesis, while the \* sign in the last two rows indicates the significant parameters, at a 5% significance level in all cases.

<sup>10</sup> For a more detailed description of the methods see Varga (2008).

compare the values of the recently computed parameters to the results of Varga (2008), we see that this trend in fact intensified in 2008-2009 relative to the period of 2006–2008.

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