PROPERLY PRICING COUNTRY RISK: A MODEL FOR PRICING LONG-TERM FUNDAMENTAL RISK APPLIED TO CENTRAL AND EASTERN EUROPEAN COUNTRIES

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Abstract

The private sector has used proxies such as sovereign credit ratings, spreads on sovereign bonds and spreads on sovereign credit default swaps (CDS) to gauge country risk, even though these measures are pricing the risk of default of government bonds, which is different from the risks facing private participants in cross-border financing. Under normal market conditions, the CDS spreads are a very useful source of information on country risk. However, the recent crisis has shown that the CDS spreads might lead to some underpricing or overpricing of fundamentals in the case of excessively low or excessively high risk aversion. In this paper we develop an alternative measure of country risk that extracts the volatile, short-term market sentiment component from the sovereign CDS spread in order to improve its reliability in periods of market distress. We show that ad-

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verse market sentiment was a key driver of the sharp increase in sovereign CDS spreads of central and eastern European (CEE) countries during the most severe phase of the crisis. We also show that our measure of country risk sheds some light on the observed stability of cross-border bank flows to CEE banks during the crisis.

Keywords: country risk, credit default swaps, credit ratings, cross-border flows, financial crisis, central and eastern Europe, foreign-owned banks

1 Introduction

Over the past two decades the composition of private capital inflows to the emerging market economies has changed significantly. The shares of foreign direct investment and portfolio inflows have decreased, while the share of international bank loans has increased. The change has been particularly pronounced in the years leading up to the latest crisis, when cross-border bank flows came to account for almost 40% of gross private capital inflows, compared to less than 10% on average in the first half of the 2000s.

Despite the greater importance of private cross-border bank loans, a benchmark for pricing country risk in such loans has not yet developed, partly because market participants associate country risk with different concepts. So far, three main proxies have emerged: sovereign credit ratings; spreads on sovereign bonds; and spreads on sovereign credit default swaps (CDS). International banks have used these measures extensively even though they are in fact pricing the risk of default of government rather than private sector debt in a given country. Given that government debt on average accounted for less than 7% of gross capital inflows to the emerging markets in the 2000s, applying these measures to cross-border loans, which accounted for 70-80% of gross inflows in many countries, might lead to potentially serious mispricing of country risk in private cross-border lending.

The latest crisis has highlighted the potential for such mispricing to occur. In the years preceding the crisis, sovereign CDS spreads emerged as a leading benchmark for pricing country risk in private lending operations. Under normal market conditions, the CDS spreads are a very useful source of information on country risk as they are flexible enough to capture changes in the relevant set of information and seem to do so earlier than changes in country credit ratings. In particular, the level of CDS premia across countries at a given point in time is clearly related to differences in default risk.

However, the relationship between the CDS spreads and country risks over time is more tenuous. The CDS spreads tend to fluctuate significantly over time and in some cases there is little apparent relationship to movements in default risk – the time variation of CDS spreads seems to be driven largely by shifts in risk appetites of investors rather than by changes in default risk. For instance, emerging market sovereign CDS premia narrowed steadily between 2004 and 2007, a period when sovereign risks were declining, as indicated by distinct increases in emerging market sovereign credit ratings. Improved ratings reflected stronger fiscal positions, lower external debts, and higher foreign reserve holdings. However, sovereign premia then surged sharply in late 2008, when there was still little evidence of worsening sovereign risks.

The use of CDS spreads might thus lead to underpricing or overpricing of fundamentals in the case of excessively low or excessively high risk aversion. Such mispricing can exacerbate market inefficiencies and add to the collapse of capital inflows during a crisis. The development of a country risk measure more closely related to fundamentals has proved to be particularly relevant during the latest crisis in central and eastern Europe. Banks in the region rely heavily on external funding, which comes mostly from foreign mother companies. Sovereign CDS spreads have been commonly used as a benchmark for pricing such loans. However, during the period of market disruption from early 2008 through the first half of 2009, sovereign CDS spreads in some cases surged 10-20 times above the pre-crisis levels, well above any increase justified by the deterioration in fundamentals. This surge in CDS spreads greatly increased the likelihood of overpricing cross-border loans to CEE subsidiaries and, given the dominant role of foreign-owned banks, threatened to cut off credit supply in local markets.

In this paper we claim that, in view of the long-term strategic focus of international banks in the CEE region, funding provided to subsidiaries should be priced according to long-term market fundamentals. Undershooting or overshooting of market risk above the long-term fundamental level might lead to excessive easing or tightening of funding conditions. We test an alternative measure of country risk that extracts the volatile, short-term market sentiment component from the sovereign CDS spread in order to improve its reliability in periods of market distress. The model is developed for the CEE countries, but is applicable to other emerging market economies as well.

Only a few papers have discussed explicitly the potential impact of crisis-related disruptions on country risk pricing. This study aims to fill this void. We estimate a panel regression between sovereign CDS spreads and the average probability of sovereign default associated with credit ratings of major rating agencies. We also use a proxy for the degree of international risk aversion in order to capture (common) shifts in market sentiment which may have contributed to the observed increase in sovereign CDS spreads. The estimated long-term coefficient and constant term from the regression are then used to calculate a new country risk premium indicator based on the average probability of default associated with credit ratings for each country. Our panel covers 14 CEE countries from January 2000 to December 2009.

We test the economic implications of these estimates on the data on cross-border bank flows to CEE and other emerging markets in order to shed light on the role played by parent banks in guaranteeing a stable source of financing during a crisis. We find that cross-border bank flows are generally better explained by the fundamental component of country-specific risk than by global risk repricing. This is particularly the case for CEE economies, where the domestic banking sector is mostly dominated by large international banking groups which generally take a long-term view when providing funding to their local subsidiaries. The pattern of cross-border flows during the latest crisis has confirmed the strong commitment of these groups to the CEE region.

The paper is structured as follows. Section 2 reviews the issue of country risk pricing for private sector operations, and describes the sovereign CDS market for CEE titles, highlighting the potential weaknesses in CDS pricing that emerged between September 2008

and March 2009. Section 3 discusses the relevance of CDS spreads as a benchmark for the pricing of country risk for banks. Section 4 reviews the literature on various models for decomposing CDS spreads. In Section 5 we estimate an alternative measure of the country risk premium that captures the long-term relationship between CDS spreads and credit ratings. Section 6 evaluates the economic implications of this measure. We test its explanatory power on the data on cross-border loans during the crisis in CEE and other emerging markets, showing that parent banks – particularly in those countries where large international banks were present – adopted a long-term perspective in the pricing of country risk. Section 7 summarises the results.

2 Pricing of country risk in cross-border financing

Pricing of country risk for sovereign borrowers is well developed and several benchmarks are widely available, including sovereign credit ratings, sovereign bond spreads (usually for bonds issued in international markets relative to benchmark risk-free bonds such as German Bunds or US Treasuries), and sovereign CDS spreads.

Pricing of country risk for private cross-border borrowers is less well developed, partly because underlying risks are more difficult to define. Different market participants associate country risk premia with different concepts, including the foreign exchange transfer risk, the risk of expropriation or government interference in the business activities of the borrower, the overall political risk, and sometimes even the economic risk of working in a less stable operating environment.

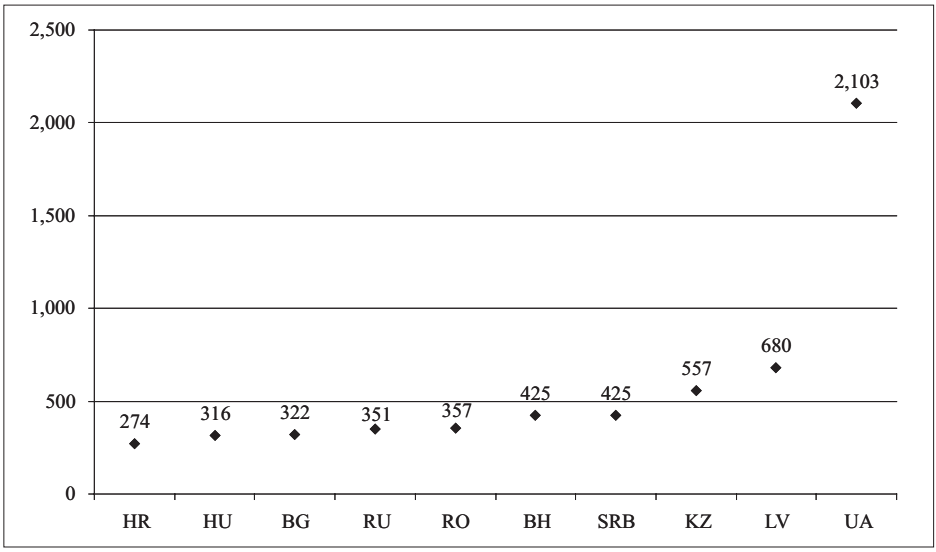
Reflecting this diversity of concepts, international banks consider at least five different measures of country risk in their cross-border financing operations.

First, export credit agencies and international financial institutions that facilitate private sector investment in developing countries have elaborated their own measures of country risk that they occasionally provide to banks on a confidential basis. For instance, the World Bank's Multilateral Investment Guarantee Agency (MIGA) and regional multilateral development banks (EIB, EBRD, IADB, ADB, etc) sometimes provide quotations of country risk premia on a deal-by-deal basis. This is a useful and often well considered measure of country risk. However, some of these institutions fulfil certain social policy functions for the international community at large – for instance, they partly subsidise country risk. Moreover, they do not face the risks they insure or price for in the same way that private institutions do. Because of their status of preferential creditors, who are the first in line to claim the assets of a bankrupt borrower, the risks they face – and hence the premia they quote – tend to be lower than those facing private creditors.

To illustrate this point, graph 1 shows differences in country risk premia measured by sovereign CDS spreads and those generated by either internal rating models of international banks or international financial institutions during 2009. The CDS spread provided in all cases the highest estimate of country risk. The lowest estimates were in some cases those generated by internal rating models of banks, and in others those quoted on a confidential basis by international financial institutions. These data indicate that the market clearly puts a higher price on country risk than individual banks or IFIs. The di-

fference ranges from about 270 basis points in the case of Croatia, to 2,100 points in the case of Ukraine.

Graph 1: Market and internal measures of country risk, difference in basis points[1]



[1] *Difference between the highest and lowest pricing of country risk in 2009. The highest pricing was for all countries represented by the market CDS spread; the lowest was given by either an internal rating model of banks or an international financial institution's confidential quote.*

Note: BH – Bosnia and Herzegovina; BG – Bulgaria; HR – Croatia; HU – Hungary; KZ – Kazahstan; LV – Latvia; RO – Romania; RU – Russia; SRB – Serbia; UA – Ukraine.

Source: UniCredit Group CEE Strategic Analysis.

The second widely used measure of country risk is the spread based on banks' internal rating models, which are built in order to comply with Basel II regulations. Such spreads are usually generated by shadow model-based systems that incorporate both quantitative information (e.g. macroeconomic data) and qualitative information (e.g. evaluation of the economic and political situation). While internal rating models tend to approximate very closely the results of rating agencies, they are more flexible to changes in the set of available information and own risk propensity of a bank.

Third, international banks rely extensively in their cross-border operations on credit ratings for sovereign and corporate bonds produced by rating agencies such as Moody's and Standard and Poor's. Bank analysts often use credit ratings as a proxy for the creditworthiness of bond issuers rather than the quality of bonds per se. In the case of sovereign bonds, for instance, the credit rating is used as a proxy for the overall level of risk – including political risk – related to investing in a particular country.

Fourth, international banks often use the spread between bonds issued in international markets and benchmark risk-free bonds. For some emerging market economies (e.g.

Brazil, Mexico, Korea, Russia, South Africa) these spreads are available for private sector corporate bonds. But in most emerging market countries private domestic companies are not large enough to issue, or to issue regularly, in international bond markets, so banks have to rely on sovereign bond spreads when assessing country risk in lending to private sector borrowers.

The fifth measure of country risk, and the one that has emerged as a key innovation in the credit risk market over the past decade, is the CDS spread. A CDS provides insurance against the risk of default by a reference entity such as a sovereign or a corporate bond issue (see Appendix box A1). In theory, CDS spreads are closely related to both bond spreads and rating changes, given that all three indicators are driven by the credit quality of private or sovereign borrowers.

In practice, CDS spreads do move together with bond spreads in the long run. But the CDS market often moves ahead of the bond market in the short run. The reasons include institutional factors (the CDS and bond markets operate differently), and the fact that the risk-free bond rates, which are used as a reference in pricing of CDS contracts, tend to move randomly (see Zhu, 2004).

Table 1: Evolution of sovereign credit ratings and CDS spreads, 2008-09

Country name	Date of rating change	Change in S&P long-term foreign currency rating	5-year CDS spread, basis points		
			On the date of rating change	Change on the date of rating revision	Change vs. previous week
Bulgaria	30/10/2008	from BBB+ to BBB	432	–64	–39
Estonia	10/08/2009	from A to A–	223	0	–8
Hungary	30/03/2009	from BBB to BBB–	523	46	3
	17/11/2008	from BBB+ to BBB	437	22	124
Latvia	10/08/2009	from BB+ to BB	617	–13	–42
	24/02/2009	from BBB– to BB+	970	43	63
	10/11/2008	from BBB to BBB–	690	127	–17
	27/10/2008	from BBB+ to BBB	921	–60	233
Lithuania	24/03/2009	from BBB+ to BBB	695	–43	–100
	27/10/2008	from A– to BBB+	608	–30	125
	30/01/2008	from A to A–	7	0	0
Romania	27/10/2008	from BBB– to BB+	610	–21	94
Russia	08/12/2008	from BBB+ to BBB	780	–35	39
Slovakia	27/11/2008	from A to A+	152	–6	12
Ukraine	25/02/2009	from B to CCC+	3,742	–34	375
	24/10/2008	from B+ to B	2,695	–108	1,022
	12/06/2008	from BB– to B+	322	–5	23

Note: Shaded areas indicate instances where the CDS spreads widened ahead of rating downgrades.
Sources: Bloomberg; S&P's; authors' calculations.

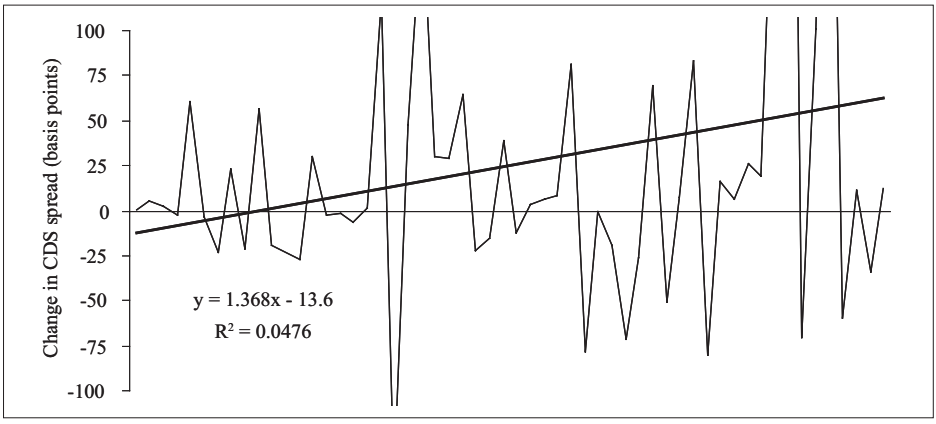
More important for the purpose of this paper is the relationship between changes in CDS spreads and changes in credit ratings. Rating agencies have stability as one of their

objectives, i.e., they try to avoid getting into a position where a rating change is made and has to be reversed a short time later. This implies that rating changes are infrequent and generally lag changes in CDS spreads. However, rating agencies base their ratings on many different sources of information, some of which are not in the public domain. The possibility of rating changes leading credit spreads therefore cannot be ruled out.

Table 1 shows the relationship between sovereign CDS spreads and rating downgrades for a sample of CEE countries during the latest crisis (the only upgrade in the table is for Slovakia, ahead of its joining of the euro area). The last two columns show that, relative to the day before the downgrade (and, in several cases, the week before the downgrade), the CDS spreads generally widened. This implies that the CDS market anticipated the downgrade, i.e., reacted to market information faster than the credit ratings.

The relationship between changes in credit ratings and changes in CDS spreads predicted by the theory – positive for downgrades negative for upgrades – is even more evident in the longer run. Graphs 2 and 3 show this relationship for a sample of 15 CEE countries from 2003 through early 2010. As shown earlier in the literature (e.g. Hull et al., 2004; Zhu, 2004), this relationship is asymmetric: the change in CDS spreads is greater for rating downgrades than for the upgrades.[1] Graph A3 in the Appendix shows that the relationship predicted by the theory also holds for *levels* of credit ratings and CDS spreads in the long run: the lower the rating, the higher the CDS spread, and vice versa.

Graph 2: CDS spreads and rating downgrades, change in CDS spreads around the time of ratings downgrade[1]



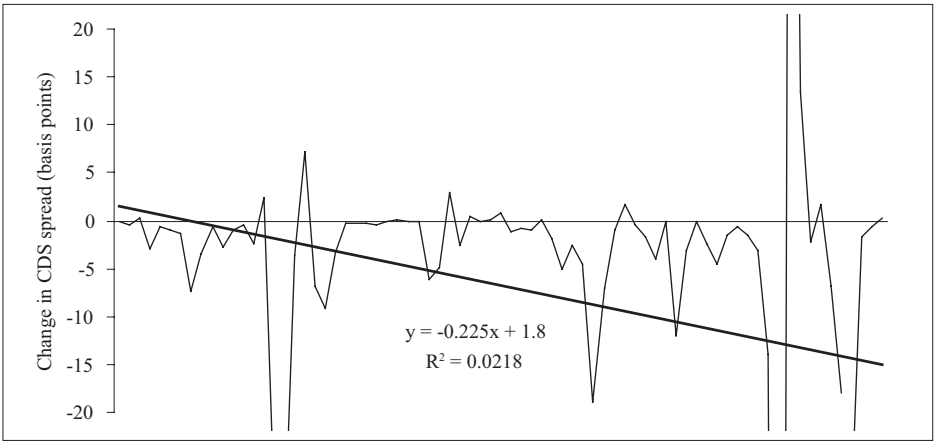
[1]Average of daily changes in CDS spreads four weeks before the ratings downgrade: the week of the downgrade; and four weeks after the downgrade; in basis points. Credit ratings are for long-term foreign currency sovereign debt.

Note: The sample of countries includes Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Kazakhstan, Latvia, Lithuania, Poland, Romania, Russia, Slovakia, Slovenia, Turkey and Ukraine; from 1 January 2003 through 16 April 2010.

Source: Authors' calculations based on market and BIS data.

[1] Note that the absolute value of the slope of the regression line in Graph 2 is greater than in Graph 3, i.e., CDS spreads widen more in the case of a rating downgrade than they narrow in the case of an upgrade.

Graph 3: CDS spreads and rating upgrades, change in CDS spreads around the time of ratings upgrade[1]



[1]Average of daily changes in CDS spreads four weeks before the ratings upgrade: the week of the upgrade; and four weeks after the upgrade; in basis points. Credit ratings are for long-term foreign currency sovereign debt.

Note: The sample of countries includes Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Kazakhstan, Latvia, Lithuania, Poland, Romania, Russia, Slovakia, Slovenia, Turkey and Ukraine; from 1 January 2003 through 16 April 2010.

Source: Authors' calculations based on market and BIS data.

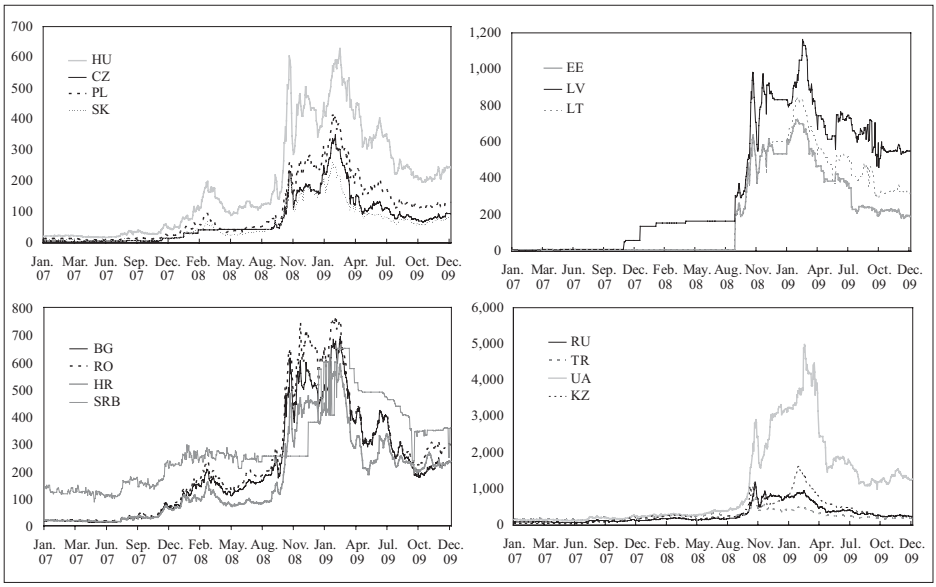
On the basis of this evidence one might conclude that the CDS spreads capture all information relevant for the assessment of country risk facing the private sector. However, the recent crisis has also shown that this market can be subject to shifts in sentiment that are unrelated to underlying country risk fundamentals. In particular, developments in the CDS market during the run-up to the latest crisis (from early 2007 through September 2008), and in the aftermath of the Lehman collapse (from October 2008 through March 2009), raise concerns that the CDS market might underprice or overprice fundamentals in the presence of excessively low or excessively high risk aversion. In particular, the breakout of the US subprime crisis in August 2007 had only a moderate impact on sovereign CDS spreads of emerging market countries (graph 4). From a market efficiency perspective this is not surprising: the emerging market sovereign debt was not at the centre of the crisis, and therefore any impact on CDS spreads should have been small.

However, the collapse of Lehman Brothers and the rescue of AIG, both of which were major counterparties in a very large number of CDS contracts, triggered a process of worldwide deleveraging and market exit in September 2008. As most markets lost liquidity, trading volumes in the CDS market collapsed, the spreads skyrocketed (graph 4) and CDS markets for some titles (including CEE sovereigns) stopped operating temporarily. This increase in spreads, however, was unrelated to any increase in default probabilities of the underlying debt: at that time, public finances in emerging markets were still unaffected by the crisis and there was no indication of worsening sovereign risks. Rather, the

increase in CDS spreads was almost entirely related to the crisis that engulfed major international investment banks participating in the CDS market.

Another piece of evidence on the existence of pricing inefficiency in the CDS market in times of distress comes from the analysis of market liquidity. A good proxy for the level of liquidity is the volatility of bid-ask spreads for the instrument being traded. The intensification of the crisis in late 2008 resulted in a significant increase in the volatility of bid-ask spreads for CEE sovereign credit default swaps: from September 2008 through March 2009, the bid-ask spread was ten times more volatile on average than in the December 2007–August 2008 period (graph 5). The huge demand for hedging in the context of low market liquidity was probably the main driver of the exponential increase in volatility of bid-ask spreads, especially for CIS countries.

Graph 4: Evolution of sovereign CDS spreads in CEE; in basis points, five-year CDS in USD



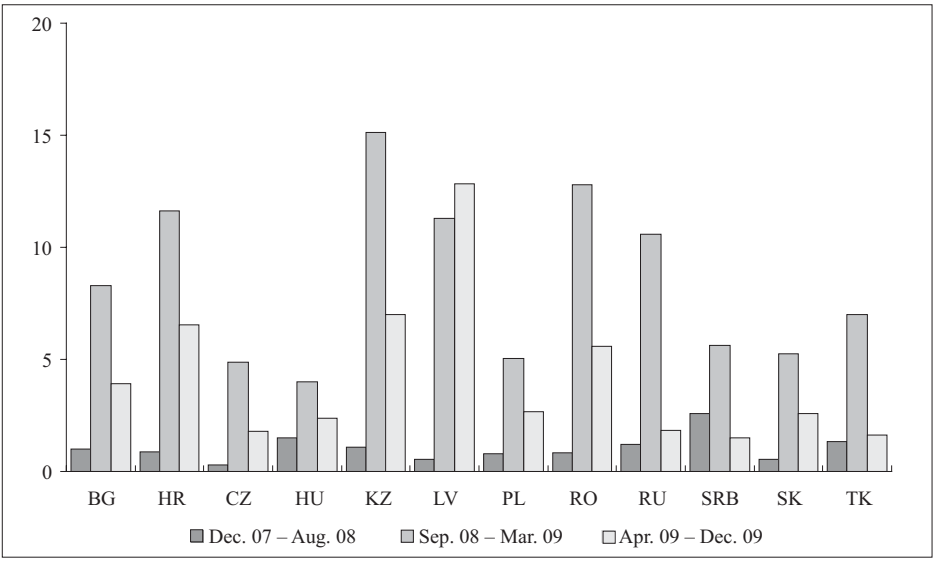
Note: BG – Bulgaria; CZ – Czech Republic; EE – Estonia; HR – Croatia; HU – Hungary; KZ – Kazahstan; LT – Lithuania; LV – Latvia; PL – Poland; RO – Romania; RU – Russia; SK – Slovakia; SRB – Serbia; TR – Turkey; UA – Ukraine.

Source: Bloomberg.

There are also a number of country-specific examples of overpricing of risk due to structural inefficiencies and high level of concentration in the CDS market. In Hungary, for instance, only a few market makers quote indicative – though not executable – prices for specific CDS maturities. None of these market makers are from the Hungarian financial sector. During 2007, the weakening of the forint was accompanied by a significant widening of CDS spreads, particularly toward the end of the year. But although the forint strengthened in the first quarter of 2008, the CDS spreads did not decrease. In contrast to the foreign exchange market, local political and economic news throughout 2008 did not

have a significant impact on CDS spreads. The only exception was the announcement of the IMF and EU aid package, where the size of the support positively surprised the market. This suggests that pricing in the Hungarian CDS market may not have reflected country risk fundamentals correctly for an extended period of time because of the oligopolistic structure of the market.

Graph 5: Volatility of bid-ask spreads in CDS markets[1]



[1] *Standard deviation of bid-ask spreads for sovereign CDS contracts.*

Note: BG – Bulgaria; CZ – Czech Republic; HR – Croatia; HU – Hungary; KZ – Kazahstan; LV – Latvia; PL – Poland; RO – Romania; RU – Russia; SK – Slovakia; SRB – Serbia; TR – Turkey.

Source: Authors' calculations based on Bloomberg.

In summary, although the level of CDS spreads across countries at a given point in time clearly reflects market information and differences in default risk, the level of spreads and country risks can be subject to pronounced misalignments over time. The CDS spreads tend to fluctuate significantly over time and in some cases there is little apparent relationship to movements in default risk. One reason for this misalignment is that the CDS spreads incorporate not only the implicit risk of default, but also changes in market sentiment. These changes are most discernible when new information comes as a shock, the timing of which is by definition unpredictable.[2] Apart from country-specific factors, the most important driver of intertemporal movements in CDS spreads is changes in risk aversion, which drive the market price of risk. Thus CDS spreads fell in the 2000s when risk aversion was declining, and jumped in autumn 2008 when risk aversion rose shar-

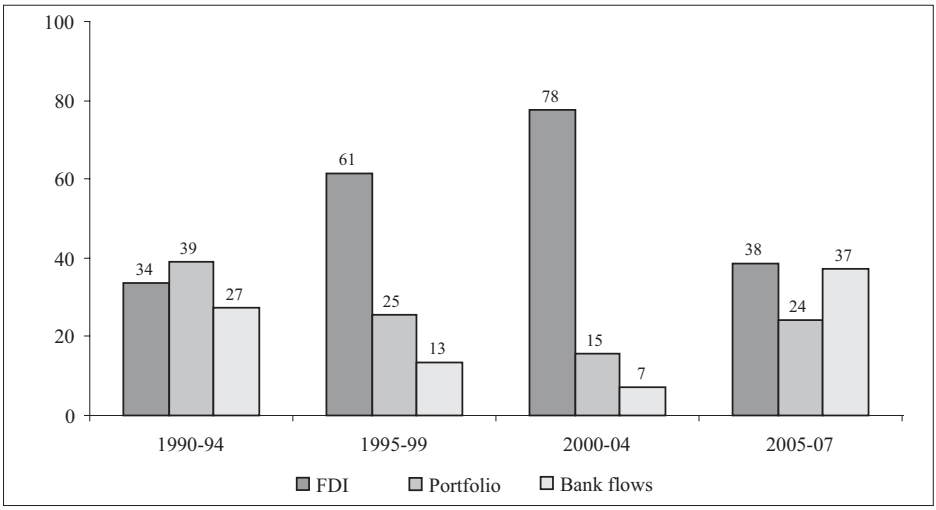
[2] One recent case in point is Greece. Greek CDS premia rose sharply after the disclosure in 2009 that the budget deficit had been understated in the past. Before that, the CDS premia had been low even though the Greek public debt to GDP ratio had been above 100% for a number of years.

ply. In addition, the nature of CDS contracts as over-the-counter derivative instruments; the size and structural opacity of the market (which seem to be correlated with high margins of major market players); and the high degree of concentration and interconnectedness of key players create an environment that may encourage market misuse and lower the informative content of CDS spreads as a measure of country risk.

3 Cross-border lending and pricing of country risk

Finding an appropriate benchmark for the pricing of country risk is particularly important in cross-border lending to the emerging markets, given the growing importance of bank-intermediated capital inflows to EMEs. Between the early 1990s and the mid-2000s, the share of cross-border bank flows decreased from 27% to 7% of gross private capital inflows (graph 6). Over this period, the share of portfolio (debt and equity) inflows also decreased significantly, while the share of FDI inflows rose to almost 80% of gross inflows. But from 2005 to 2007 these trends reversed sharply: the share of cross-border inflows increased to 37%; the share of portfolio inflows to 24%; while the share of FDI inflows halved to 38%. These shifts were even more pronounced in some countries, especially in CEE, where cross-border bank flows came to account for up to 80% of gross private capital inflows.

Graph 6: Composition of gross private capital inflows to EMEs,[1] in percent of total



[1] Period averages. Includes 29 most important emerging market economies from Asia, Latin America and central and eastern Europe, as well as Saudi Arabia and South Africa.

Sources: BIS; IMF; authors' calculations.

Finding an appropriate benchmark for the pricing of sovereign risk is also important for CEE countries because of the significant role played by foreign banks in the region and the resulting dependence of local banking systems on foreign funding. In the years

before the crisis, banking systems in CEE experienced a veritable deluge of cross-border bank inflows. The stock of external liabilities of local banks at end-2008 was more than four times higher than at end-2004. As domestic saving rates in CEE were low and the region was catching up rapidly with the EU, foreign-owned banks began to channel large amounts of external funds to local banks and the non-bank sector in the mid-2000s. In most countries of the region large international banks were funding their local subsidiaries through direct intra-company loans. In Russia, Kazakhstan and few other countries, large domestic corporations tapped the global capital market through international bond issues and direct borrowing from international banks. The dependence on foreign funding has been particularly high in the Baltic States and south-eastern Europe. The Czech Republic, Slovakia and Turkey have been less dependent on foreign funding because of their relatively large domestic deposit base (Appendix graph A4).

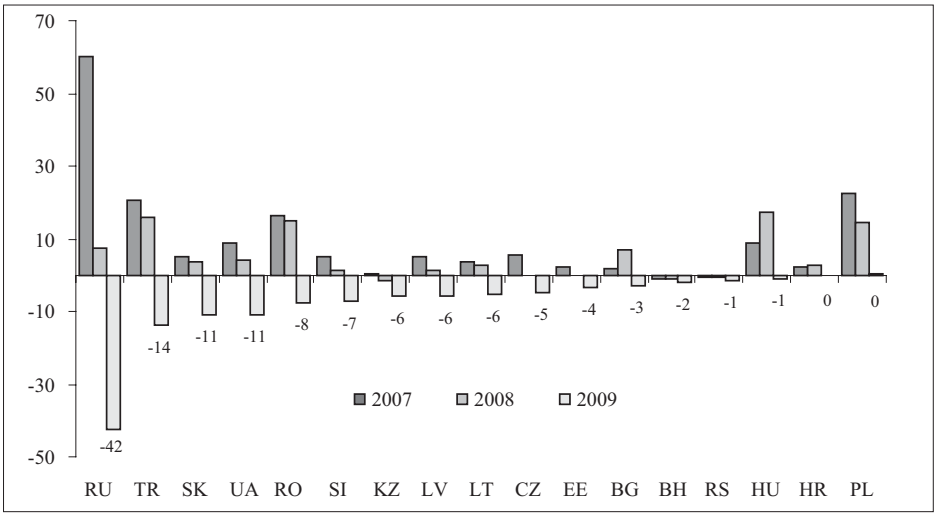
When the crisis erupted, proper pricing of funding to the local banking sector in CEE became a key issue. In those countries where banks used to fund their activities by borrowing in international capital markets, funding was completely cut off. In those countries were foreign banks were present as strategic investors, funding continued to flow, but fixing the right price became a major challenge. Banks used to price their own funds to local subsidiaries using the sovereign CDS spreads as a measure of country risk, despite the drawbacks mentioned above. But during the crisis the inefficiencies in the CDS market came to full light. Sovereign CDS spreads ceased to represent a reliable measure of long-term fundamental country risk and became excessively tied to the short-term market sentiment.

Long-term strategic investors had to adjust by developing risk pricing techniques that smoothed the peaks in CDS pricing while still taking into account changes in country risks. Reflecting these adjustments, cross-border bank flows to the region were not disrupted as seriously as feared (graph 7), despite the fact that financial markets were seriously hit by the crisis and the whole region (except for Poland) plunged into deep recession (see Mihaljek, 2010). Major international banks thus demonstrated that they had a long-term horizon when deciding their funding strategy to local subsidiaries in this region. By contrast, in countries such as Russia, where cross-border bank flows were not related to intra-group funding, the reduction of inflows was much sharper, probably because foreign creditors continued to price risk according to the CDS benchmark, thus overreacting to the crisis.[3]

Although the economic growth model of CEE countries and the business model of international banks active in the region will likely be readjusted, CEE is expected to remain dependent on external financing for the foreseeable future. This reinforces the need to develop a proper benchmark to price the country risk. Underpricing of risks might lead to a new round of excessive lending and asset price increases. Overpricing might lead to excessive tightening of capital inflows, which would hamper the long-term growth.

[3] Slovakia is a special case, partly because it adopted the euro in 2009 (see Mihaljek, 2010). Note that the changes shown would be considerably smaller if they were expressed in terms of GDP or private sector credit.

Graph 7: Evolution of cross-border financing of CEE economies,[1] in billions of USD



[1] *External loans of BIS reporting banks vis-à-vis individual countries banking sector, exchange rate adjusted changes in gross amounts outstanding.*

Note: BH – Bosnia and Herzegovina; BG – Bulgaria; CZ – Czech Republic; EE – Estonia; HR – Croatia; HU – Hungary; KZ – Kazahstan; LT – Lithuania; LV – Latvia; PL – Poland; RO – Romania; RS – Serbia; RU – Russia; Sl – Slovenia; SK – Slovakia; TR – Turkey; UA – Ukraine.

Source: Authors' calculation based on BIS data.

4 Review of the literature on CDS spreads decomposition

Although credit default swaps are a relatively recent financial innovation, there is already a large literature on their pricing and valuation. Two main theories on CDS pricing have emerged so far: the "probability model", which looks at the present value of a series of cash flows weighted by their probability of non-default; and the "no-arbitrage model" of Duffie (1999) and Hull and White (2000a and 2000b).

The relatively small empirical literature has focused on the determinants of CDS spreads and their role in forecasting rating events. Cossin and Hricko (2001) showed that the determinants of CDS premia were quite similar to those of bond spreads, including ratings, yield curves, stock prices and leverage ratios. Houweling and Vorst (2001) and Hull et al. (2003) compared the credit risk pricing between the bond market and the CDS market. Both papers found that, when swap rates were used as benchmark risk-free rates, the price discrepancies between bond spreads and CDS premia were quite small (about 10 basis points). Moreover, Hull et al. (2003), and Norden and Weber (2004a and 2004b) found strong evidence that the CDS market anticipated credit rating announcements, particularly negative rating events. The strong impact of negative rating events on CDS spreads was also found by Micu et al. (2004).

Zhu (2004) confirmed the theoretical prediction that bond spreads and CDS spreads moved together in the long run, but found that this relationship did not always hold in the short run. The deviation was largely due to different responses of the two markets to changes in credit conditions; in particular, the CDS market often moved ahead of the bond market in price adjustment. Varga (2009) found that Hungary's credit risk premium was primarily defined in the Hungarian sovereign CDS market, i.e., new information pertaining to Hungary's credit risk was captured by CDS spreads ahead of the foreign currency bond market. Nevertheless, during particularly turbulent market periods, Hungarian sovereign CDS spreads tended to rise higher than was fundamentally justified. Varga also noted that the CDS spreads of emerging market countries with a higher credit rating were often significantly higher for an extended period than the average CDS spreads of lower-rated countries.

5 Alternative measure of country risk premium: econometric approach

The above findings suggest that in periods of market distress the component of CDS spreads that captures short-term risk aversion and market sentiment tends to drive the spreads. To gain an insight into this issue, in our empirical analysis we test an alternative measure of country risk premium based on the long-term relationship between CDS spreads and external ratings, which are taken to reflect the fundamental component of country risk. This allows us to extract from the CDS spreads the volatile short-term component that is subject to extreme fluctuations when markets are disrupted. In addition, we use a proxy for the degree of international risk aversion to capture shifts in market sentiment which may have contributed to the widening of sovereign CDS spreads beyond fundamentals.

5.1 Data

Our data set comprises monthly data for the period 2000-09 covering 14 CEE countries grouped into two main panels: new EU member states (Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania and Slovakia), and other CEE, which includes two EU candidates (Croatia and Turkey), one potential candidate (Serbia), plus Kazakhstan and Russia.

The dependent variable is the sovereign CDS spread. Given that for some maturities market data are not available (or the underlying securities are illiquid), we opted for spreads on five-year CDSs in US dollars provided by Bloomberg, as these turn out to be among the most liquid credit default swaps. The regressions are computed using the logarithm rather than the level of CDS spreads, because changes in credit ratings are generally not followed by linear changes in CDS spreads.

The main explanatory variable is the probability of default on a sovereign bond. This data series is obtained from a conversion matrix based on multi-year cumulative default rates for sovereign issuers calculated by the main rating agencies – Moody's, S&P's and Fitch. Cumulative defaults rates associated with each rating scale are generally based on a "static pool" approach. In the case of S&P's, for example, they are obtained by calculating marginal weighted average default rates conditional on survival (survivors being

non-defaulters) for each possible time horizon, and accumulating marginal default rates. The cumulative default rate is then equal to one minus the proportion of survivors. In our regressions we use a simple average of cumulative default probabilities by the three rating agencies in order the better to reflect the "consensus" view on country risk.

The enormous criticism of rating agencies in light of the latest financial crisis has brought into question the reliability of ratings as an indicator of long-term probability of default. Rating agencies have often been blamed for reacting after the fact rather than anticipating changes in fundamentals. The rating changes have often turned out to be procyclical and a possible cause of market instability. Although we are sympathetic to some of this criticism, we would like to point out that rating agencies provide the only externally available estimates of the probability of sovereign default. Efforts to build a more accurate measure of the probability of sovereign default would go far beyond the scope of this paper. One should also admit that, over a longer time period, the performance of rating agencies in the sovereign area has not been so bad, especially in comparison to the newer instruments such as CDOs. Large changes in sovereign credit ratings have been relatively uncommon, especially for higher rated countries, and the percentage of unchanged ratings declines with the passage of time.[4]

To model the observable shifts in global risk aversion, we use the Chicago Board Options Exchange Volatility Index, also known as the VIX. Although the VIX mainly measures market expectations of near-term volatility in the S&P 500 index, it is also a good proxy of future volatility in global financial markets. The VIX also helps identify episodes of lower- and higher-than normal volatility and thus allows us to define more precisely periods of financial market disruption. This approach is hence preferable to the use of crisis dummies, which is always somewhat arbitrary.

5.2 Estimation approach and results

Following Varga (2009), we estimated a panel regression with logarithm of CDS spreads as the dependent variable, and average probability of sovereign default and a proxy for global risk aversion as explanatory variables:

$$log(CDS_{i,t}) = \alpha_0 + \alpha_1 PD_{i,t} + \alpha_2 VIX_t + u_i + \varepsilon_{i,t}$$

where $CDS_{i,t}$ is the sovereign CDS spread for country i at time t; $PD_{i,t}$ is the average rating agencies' probability of default for sovereign bonds of country i at time t; VIX_t is the Chicago Board Options Exchange Volatility Index at time t; u_i is an unobserved country specific effect; and $\varepsilon_{i,t}$ is the error term.

The model was estimated using two techniques: fixed effects and OLS with panel-corrected standard errors (PCSE). The choice of the fixed effects estimation was based on the Hausman test, which consistently showed that the fixed effects model was preferred over the random effects model. The intuition behind this result is that the determinants of CDS spreads are correlated with country-specific effects (see Varga, 2009). We also report an OLS estimator with panel-corrected standard errors, following the approach pro-

[4] For more details, see Standard & Poor's (2010).

posed by Beck and Katz (1995). This approach helps address a potential inconsistency of estimators in the presence of heteroskedasticity and spatial correlation among panels. To check the robustness of the relationship between the CDS spreads and credit ratings the model was first estimated on the full sample of countries, and then on the two subsamples, the EU members and other CEE countries.

Table 2: Estimated relationship between sovereign CDS spreads and sovereign default probabilities

	Estimate 1 Full sample FE	**Estimate 2 Full sample PCSE**	**Estimate 3 EU sample PCSE**	**Estimate 4 Other CEE sample PCSE**
Constant	1.9730	1.8033	1.3305	2.9301
	[0.000]***	[0.000]***	[0.000]***	[0.000]***
PD	0.1958	0.2435	0.2354	0.1767
	[0.000]***	[0.000]***	[0.000]***	[0.000]***
VIX	0.074	0.0724	0.0859	0.0536
	[0.000]***	[0.000]***	[0.000]***	[0.000]***
Observations	1,082	1,082	648	434
No. of groups	14	14	9	5
R^2		0.7242	0.7265	0.7239
R^2 within	0.6592			
Hausman test	chi^2 (2) = 6.80 Prob>chi^2 = 0.0333			

Note: p-values in brackets. FE refers to fixed effects estimates, PCSE to OLS estimates with panel-corrected standard errors.

* *Significance at 10%.*

** *Significance at 5%.*

*** *Significance at 1%.*

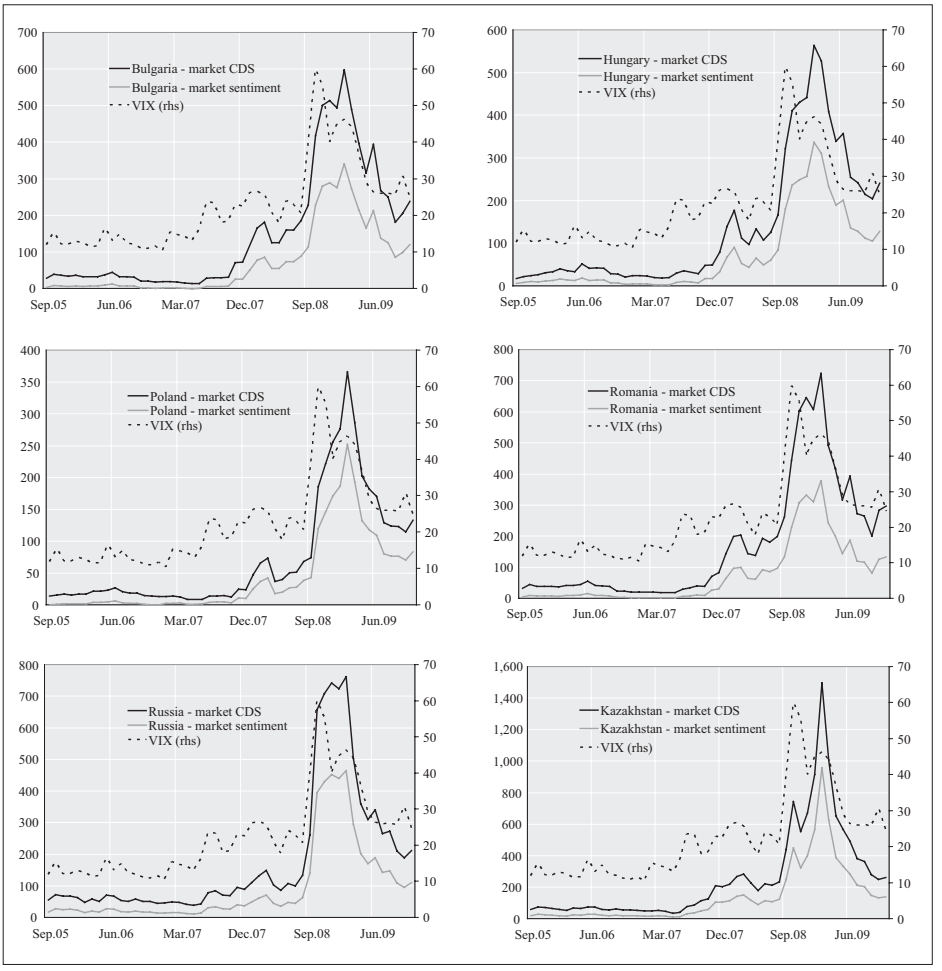
Source: Authors' calculations.

The results are shown in table 2. The estimates confirm that a statistically significant positive relationship exists between the CDS spreads and the probability of sovereign default measured by external credit ratings. A 1% increase in the probability of sovereign default is estimated to increase the corresponding CDS spread on average by about 0.20%. The estimated risk aversion coefficient indicates that an increase in market volatility of 1% translates into an average increase in CDS spreads of about 0.07%. This implies that in the aftermath of the Lehman collapse, when market volatility increased in the order of about 2,500 basis points compared to the 2000-08 historical average, the average increase in CDS spreads was around 170 basis points, regardless of any change in underlying default probabilities. The estimated coefficients are fairly stable across different specifications.

The estimates from table 2 can be used to calculate a long-term "fundamental" and a short-term "market sentiment" component of the CDS spread. The results of this decomposition are shown in graph 8, where we used the estimated coefficient on the probability

of default from Estimate 2 in table 2 to obtain the long-term fundamental component of the spread. Adverse market sentiment, shown as the area below the yellow line in graph 8, was clearly a key driver of the sharp increase in sovereign CDS spreads during the most severe phase of the crisis from September 2008 through March 2009.

Graph 8: Decomposition of CDS spreads: fundamental and market sentiment components[1]



[1] *The market sentiment component of the CDS spread is obtained as the difference between the market CDS spread and the estimated long-term fundamental component based on sovereign default probability.*

Source: Authors' calculations.

Table 3 shows the size of these two components of CDS spreads in 2009. For EU member countries, the long-term fundamental component of CDS spreads – which represents our measure of the country risk premium – "explained" on average between 35%

(Estonia) and 53% (Romania) of the market CDS spread. For other CEE countries, the fundamental component "explained" between 41% (Kazakhstan) and 68% (Turkey) of the market CDS spread. In other words, out of the 300 basis points CDS spread for Croatia in 2009, only about half represented a fundamental country risk premium, while the other half represented the impact of market sentiment factors – both observable and unobservable – that were unrelated to Croatian economic fundamentals.

Table 3: Market CDS spread and its estimated fundamental component; in basis points, for five-year CDS contracts in USD

	Market CDS spread	Estimated fundamental component of CDS spread	Percentage of CDS spread explained by the fundamental component
	2009 average, in basis points		
	(a)	(b)	(b) / (a)
EU members			
Bulgaria	352	165	47
Czech Rep.	136	50	37
Estonia	382	133	35
Hungary	336	149	44
Latvia	710	328	46
Lithuania	498	205	41
Poland	190	67	35
Romania	391	206	53
Slovakia	106	42	39
Other CEE			
Croatia	304	146	48
Serbia	458	257	56
Russia	374	163	44
Kazakhstan	587	241	41
Turkey	283	193	68

Sources: Authors' calculations, Bloomberg.

6 Implications for cross-border bank flows

To evaluate the implications of alternative country risk measures for cross-border bank flows we estimated an additional set of regressions where the dependent variable was cross-border loans to banks, and the explanatory variables were our measure of the country risk premium and the VIX as a proxy for global, common and observable risk aversion. The model was tested for an extended panel of 21 emerging market countries including 14 CEE economies from our sample and seven Asian emerging markets (China, Indonesia, Korea, Malaysia, the Philippines, Thailand and Vietnam). We selected these economies in order to analyse the reaction of cross-border loans to shifts in long-term country fundamentals and risk aversion in countries with different degrees of foreign ownership in the banking sector, i.e., a generally high degree of foreign ownership in CEE and a low degree in emerging Asia.

We first estimated the model for the whole sample, adding a dummy variable with a value of 1 for countries with more than 50% of foreign-owned assets in the banking sector and a value of 0 otherwise. Next we estimated the model for the panels with low and high degrees of foreign bank ownership. The first panel included countries where foreign banks own from 10% to 35% of banking sector assets: Asian emerging economies, Kazakhstan, Russia and Turkey. The second panel included the remaining CEE countries, where foreign bank ownership shares exceed 50% of total banking sector assets.

Data on cross-border loans were taken from the BIS locational banking statistics. We looked at exchange rate-adjusted changes in cross-border loans to banks as a percentage of the borrowing country GDP. To isolate the impact of shifts in global risk aversion on cross-border bank flows we focused on the period from Q3:2005 to Q4:2009. The estimates were done using the OLS with panel-corrected standard errors.

As indicated in table 4, the results of the regression on the full sample confirm that cross-border bank flows react negatively to increases in the country-specific component of sovereign risk as well as to increases in global risk aversion, while the impact of foreign bank ownership is positive. More precisely, a 1% increase in our measure of country risk reduces cross-border bank flows by 0.004% of GDP per quarter; a 1% increase in global risk aversion reduces the flows by 0.024%; while a percentage point higher foreign bank ownership increases cross-border flows by 0.6%.

Table 4: Cross-border flows and alternative measures of country risk premium

	Estimate 1 Full sample	**Estimate 2 High foreign bank ownership sample**	**Estimate 3 Low foreign bank ownership sample**
Constant	0.9743	1.6063	0.8408
	[0.000]***	[0.002]***	[0.000]***
Country risk premium	–0.0040	–0.0060	–0.0019
	[0.013]**	[0.032]**	[0.098]*
VIX	–0.0237	–0.0185	–0.0279
	[0.084]*	[0.461]	[0.000]***
Foreign bank ownership	0.5806		
	[0.013]**		
No. of observations	330	171	159
No. of groups	20	11	9
R^2	0.120	0.088	0.144

Note: p-values in brackets. OLS estimates with panel-corrected standard errors.

* *Significance at 10%.*
** *Significance at 5%.*
*** *Significance at 1%.*

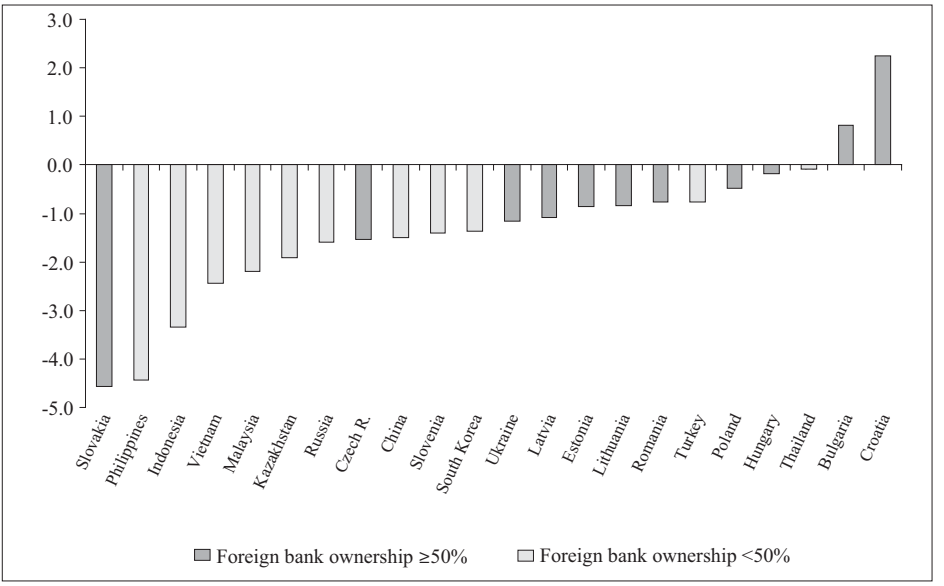
Source: Authors' calculations

In the sample of countries with a high degree of foreign bank ownership, the estimated country risk coefficient is 50% higher than in the full sample: a 1% increase in our measure of fundamental country risk reduces exchange rate-adjusted cross-border flows

to banks in CEE by 0.006% of GDP in a quarter. The coefficient of global risk aversion is statistically insignificant for this group of countries. By contrast, in the sample of countries with a low degree of foreign bank ownership, the estimated country risk coefficient is 50% lower than in the full sample, and the coefficient of global risk aversion is statistically highly significant.

These results suggest that cross border bank flows are strongly correlated with the presence of foreign-owned banks in the domestic banking sector. This evidence is consistent with the observed stability of cross-border bank flows to CEE countries after the Lehman collapse, including at the peak of the crisis in Q1:2009. At the time, parent banks from western Europe provided large amounts of liquidity support to their local subsidiaries in CEE, making a judgment – which ex post turned out to be correct – that long-term fundamentals in the region had not deteriorated as much as suggested by headline measures of country risk such as the CDS spreads or measures of global risk aversion such as the VIX. Banks in Asian emerging economies had a different experience: reflecting a large increase in global risk aversion, foreign-owned banks withdrew large amounts of liquidity from local banking systems during this period, even though country fundamentals in emerging Asia deteriorated very little. As indicated in graph 9, countries with a high degree of foreign bank ownership indeed experienced a smaller decrease (or in some cases, saw an

Graph 9: Evolution of cross-border bank financing in emerging markets;[1,2] percentage change in cumulative cross-border flows, 2008-09 vs. 2006-07



[1] Based on exchange rate adjusted changes (in USD) in external loans of BIS reporting banks vis à-vis individual countries' banking sector.

[2] Foreign bank ownership as a percentage of total banking sector assets.

Source: Authors' calculation, based on the BIS data.

increase) in cross-border bank flows during 2008-09 relative to 2006-07, compared with countries with a low degree of foreign bank ownership. As noted above, Slovakia is an exception – foreign-owned banks used the highly liquid Slovak banking system to obtain liquidity for their headquarter operations during the crisis (see Mihaljek, 2010).

7 Summary and conclusions

In recent years sovereign CDS spreads have emerged as a leading benchmark for private sector pricing of country risk in international business operations, including cross-border bank lending. Under normal market conditions, the CDS spreads represent a very useful source of information on country risk, as they capture changes in the set of available information much earlier than the rating changes. However, the CDS market can be subject to rapid shifts in sentiment that are unrelated to underlying country risk fundamentals. This can in turn lead to underpricing or overpricing of sovereign risk, thus lowering the informative content of CDS spreads as a measure of country risk.

Finding a proper benchmark with which to price sovereign risk is of particular importance for CEE countries because of the large role played by foreign banks in the region and the high dependence of local banking systems on foreign funding. In this paper, we tested an alternative measure of country risk premium based on a long-term relationship between CDS spreads and external ratings, which are taken to reflect the fundamental component of country risk. Our findings suggest that adverse market sentiment was a key driver of the sharp increase in sovereign CDS spreads of CEE countries during the most severe phase of the crisis, from September 2008 through March 2009. Our measure extracted the volatile short-term component of CDS spreads from the country risk premium and was therefore more stable in the period of market distress.

Our measure of country risk also helps explain the stability of cross-border flows to banks in countries with a high degree of foreign bank ownership. In particular, cross-border flows to CEE countries with a high degree of foreign bank ownership have been driven to a much greater extent by country risk fundamentals and to a much lesser extent by global risk aversion than cross-border flows to banks in emerging Asia, Kazakhstan, Russia and Turkey, which have a considerably smaller presence of foreign banks. This evidence confirms that major international banks have a long-term horizon in funding of their local CEE subsidiaries.

APPENDIX

Box A1: Main features of CDS markets

The credit default swap in its simplest form is a contract between two private parties in which the buyer of the CDS makes a series of payments to the seller and in exchange receives a payoff if a specified credit instrument ("reference entity"), typically a bond or loan, undergoes a defined "credit event" such as a failure to pay, restructuring or default. Although the CDS contract refers to a specified bond obligation, usually a corporation or government, the reference entity is not a party to the contract. The protection buyer makes quarterly premium payments, the "spread", to the protection seller. If the reference entity defaults, the protection seller usually pays the buyer the par value of the bond in exchange for physical delivery of the bond.

The largest players in the global CDS market are commercial banks, insurance companies, financial guarantors and hedge funds. Banks figure prominently on both the buying and selling sides of the market because CDS contracts offer them an attractive way to transfer the credit risk associated with the loans they have made without removing these assets from their balance sheets and without involving the borrowers. Insurance companies, financial guarantors and hedge funds primarily act as sellers of protection in the CDS market, because it offers them an opportunity to enhance investment yields via arbitrage, hedging and speculation involving CDS contracts.

The spread paid by the protection buyer to the seller is quoted in basis points per annum of the contract's notional value and is usually paid quarterly. The CDS spread is a different concept from the yield spread of a bond: it is not based on any risk-free bond or benchmark interest rates, but rather indicates the annual price of protection in basis points of the notional value of the bond. For instance, a CDS spread of 300 basis points indicates that the buyer of the CDS has to pay the seller $300,000 annually in order to insure a notional amount of $10 million of a given bond. Most CDS contracts are in the $10-20 million range with maturities between one and 10 years, with the five-year maturity being the most common tenor.

Although CDS contracts have been compared with insurance – because the buyer pays a premium and in return receives a payment if one of the events specified in the contract occurs – there are a number of important differences between CDS and insurance contracts.

- To purchase insurance, the buyer is generally expected to have an insurable interest such as owning a debt obligation. In contrast, the buyer of a CDS does not need to own the underlying bond or other form of credit exposure, or does not even have to suffer a loss from the credit event.
- The cost of insurance is based on actuarial analysis, whereas CDS are derivatives whose cost is determined using financial models and arbitrage relationships with other credit market instruments such as loans and bonds from the same reference entity.
- While insurers manage risk primarily by setting loss reserves based on the law of large numbers, dealers in CDS contracts manage risk primarily by means of offsetting CDS contracts, i.e., by hedging with other dealers and entering into transactions in underlying bond markets.
- Insurance contracts require the disclosure of all known risks involved. CDS contracts have no such requirement.
- Unlike insurance companies, sellers of CDS contracts are not required to maintain any capital reserves to guarantee payment of claims. Banks, which are major CDS dealers,

are subject to bank capital requirements, but they typically keep CDS contracts off their balance sheets and hence do not necessarily keep reserves for contingent payments.

- While an insurance contract provides an indemnity against the losses actually suffered by the policy holder, the CDS provides an equal payout to all holders, calculated using an agreed, market-wide method.

When entering into a CDS contract, both the buyer and the seller of credit protection take on counterparty risk: the buyer takes the risk that the seller will default and that he will thus lose protection against default by the reference entity; the seller takes the risk that the buyer will default and thus stop making the agreed payments on the contract. The CDS contracts also involve liquidity risk: if one or both parties to a CDS contract must post collateral (which is common), there can be margin calls requiring the posting of additional collateral. The counterparty and liquidity risks figured prominently in the latest financial crisis, notably in the case of the bankruptcies of Lehman Brothers and American Insurance Group (AIG), both of which were major players in the CDS and other derivative markets.

If a credit event specified in the CDS contract occurs, the seller of the CDS can compensate the buyer via either physical or cash settlement. In a physical settlement the protection seller buys the distressed loan or bond from the protection buyer at par. In a cash settlement the payment from the seller to the buyer of a CDS is determined as the difference between the notional and market value of the reference obligation. Market value of the distressed obligation is typically determined in an auction (also known as a *credit-fixing event*) in which participating dealers (e.g., big investment banks) submit prices at which they would buy and sell the reference entity's debt obligations, as well as net requests for physical settlement against par.

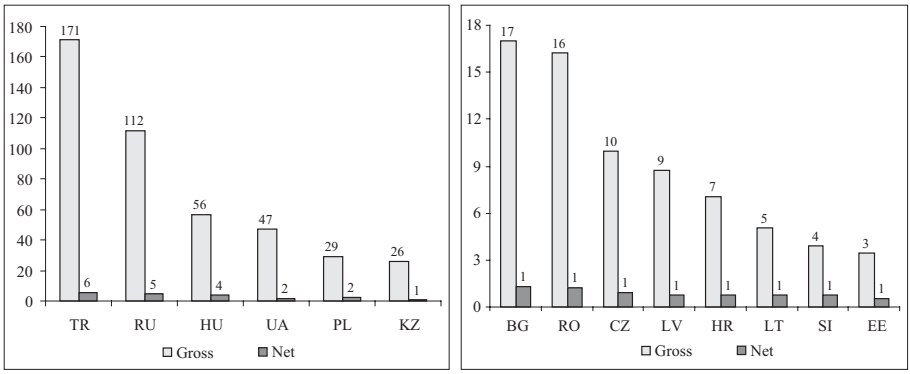
In the early stages of CDS market development, documentation for CDS contracts was not standardised, which led to many disputes when credit events occurred. Since then, documentation has been standardised to a great extent. Trading of CDS contracts is expected to shift from "over the counter" transactions to central clearing houses, which will act as central counterparties to both sides of a CDS transaction, thus practically eliminating the counterparty risk.

Since the introduction of first credit default swaps in the late 1990s, the CDS market has expanded exponentially.[1] According to the BIS derivatives statistics, the notional amount outstanding of sovereign CDS increased from around $870 billion at the end of 2004 to $1,660 billion at the end of June 2008, which corresponds to an annual growth rate of 20%. From end-June 2008 to end-June 2009, however, the sovereign CDS market shrank by 20%.

In CEE, the gross notional amount of sovereign CDS contracts outstanding as of mid-February 2010 was around $515 billion. About 55% of the market was accounted for by the contracts insuring against the default of Turkish and Russian bonds, with the next 30% insuring against the default of Hungarian, Kazakh, Polish and Ukrainian sovereign bonds (graph A1). The total number of contracts with CEE sovereigns as reference entities was around 42,000 as of mid-February 2010 (graph A2). The average size of a contract was around $10.5 million.

[1] *The first modern credit default swaps were apparently developed in 1997 by a team working for JPMorgan Chase. They were designed to protect the EBRD from the risk of default of Exxon.*

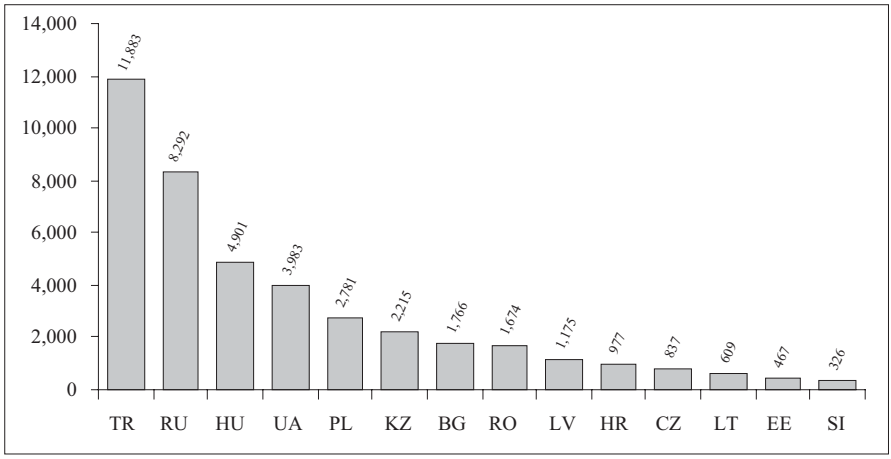
Graph A1: CDS volumes of central and eastern European sovereigns; notional amounts as of 12 Feb. 2010, in billions USD



Note: BG – Bulgaria; CZ – Czech Republic; EE – Estonia; HR – Croatia; HU – Hungary; KZ – Kazahstan; LT – Lithuania; LV – Latvia; PL – Poland; RO – Romania; RU – Russia; Sl – Slovenia; TR – Turkey; UA – Ukraine.

Source: DTCC.

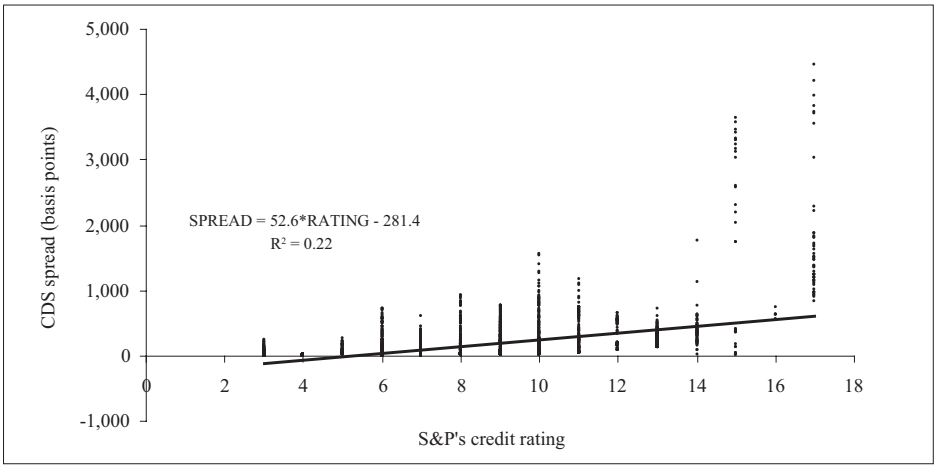
Graph A2: Number of CDS contracts on CEE sovereigns, as of 12 Feb. 2010



Note: BG – Bulgaria; CZ – Czech Republic; EE – Estonia; HR – Croatia; HU – Hungary; KZ – Kazahstan; LT – Lithuania; LV – Latvia; PL – Poland; RO – Romania; RU – Russia; Sl – Slovenia; TR – Turkey; UA – Ukraine.

Source: DTCC.

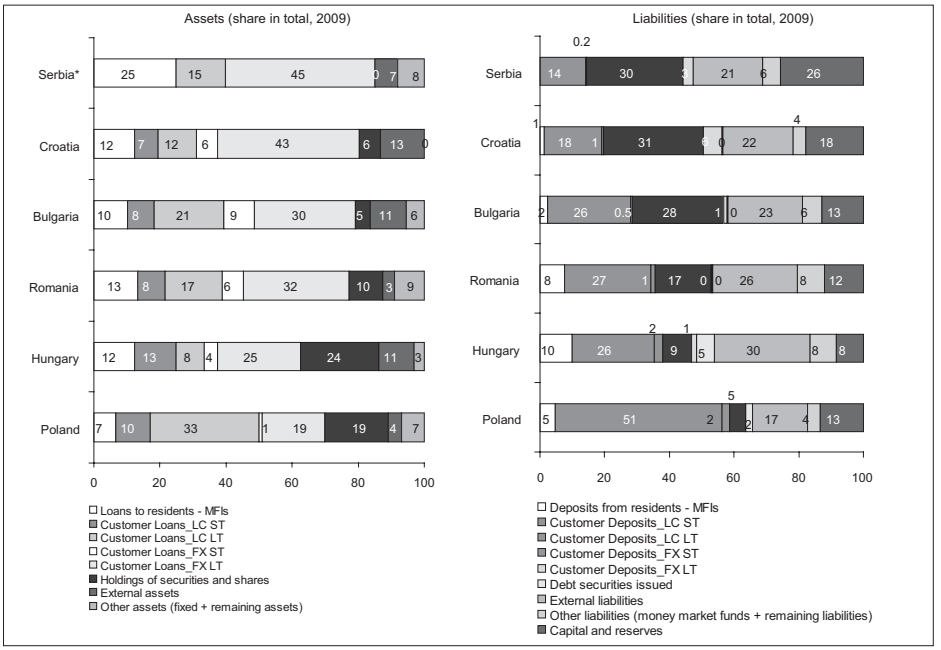
Graph A3: Sovereign credit ratings and CDS spreads



Note: The horizontal axis measures S&P's sovereign credit ratings on a scale from 1 (AAA) to 23 (SD). The sample of countries includes Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Kazakhstan, Latvia, Lithuania, Poland, Romania, Russia, Slovakia, Slovenia, Turkey and Ukraine; from 1 January 2003 through 16 April 2010.

Source: Authors' calculations.

Graph A4: Banking sector balance sheet in selected CEE countries, percentage



Note: For Serbia, breakdown of customer loans by maturity not available.

Source: UniCredit Group CEE Strategic Analysis.

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