Do Major Financial Crises Provide Information on Sovereign Risk to the Rest of the World? A Look at Credit Default Swap Markets

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Abstract

The financial innovations of the late 1990s have led to the emergence of a significant number of new instruments, in particular in the market for hedging credit risk. This paper, based on an original dataset of transactions and quotes, looks at credit default swaps drawn on sovereign countries. The study of the credit default swap market around major financial crises leads to several results: Markets' consideration of ratings around the world changes dramatically after major financial crises, even for those countries that are not in crisis. While ratings seem suddenly to matter more, pricing uncertainty increases as well. Thus large financial crises appear to create strong information uncertainty, rather than resolve previous uncertainty. After a major crisis event, there is significant 'flight-to-quality' that is accompanied by a strong relative rise of demand for sovereign credit protection. We also document the extra-significance of transaction data compared to quote data in an OTC market. Overall, sovereign ratings appear to be the pricing tool of last resort when crises disturb markets.

JEL Codes: G13, F34, G15

Keywords: Credit Default Swaps, Sovereign Risk, Financial Crises, Event Study

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Executive Summary

The financial innovations of the late 1990s have led to the emergence of a significant amount of new instruments, in particular in the market for hedging credit risk. Credit default swaps (CDS) are the most popular specimen in the emerging world of credit derivatives. In recent years, much of the academic literature has focused on the theory on valuation issues of such instruments in the corporate case (Duffie (1998), Hull and White (2000)), but far less work has focused on empirical aspects (Cossin *et al.*, (2002), and Houweling and Vorst (2001)) and no work that we know of has looked at it as an indicator of sovereign risk information.

Default swaps are used to exchange risks that are already traded, but not separately, in existing markets such as in bond markets (where sovereign risk is not separated from interest rate risk). The underlying instruments on which credit derivatives on sovereign risk are written are typically Brady bonds or other sovereign bond issues. Credit default swaps are financial instruments that allow lenders to pass on to others the risk that borrowers will default, in return for a recurring payment: the CDS rate. The seller of the swap typically agrees, in case of a credit event, to take over the debt at face value.

Research on Credit Default Swaps has important implications for a better understanding of sovereign risk behavior, and represents an opportunity to study credit risk from another angle than the usual instruments studied in the literature such as bonds and swaps. Credit default swaps, only marginally present up to the 1990s, have become an increasingly valuable instrument used by market participants to hedge credit risk. It is appealing to banks and other financial institutions, since it allows to buy protection for their loan portfolios and to take credit risk without having to finance it. One of the major features of credit derivatives is the allowance of the transfer of pure credit risk from one counterparty to another. Positively, credit derivatives have fostered improved liquidity in the cash credit market by making it easier to access a diversified portfolio of names and, when desirable, actively 'short' credit risk. Moreover, the market does appear to be moving toward greater liquidity and diversification as more reference entities are actively traded.

Analyzing credit risk via its most popular instrument has important advantages with respect to analyzing the behavior of bond spreads: i) CDSs are by far the most liquid instrument in the family of credit derivatives, ii) CDSs are not subject to the distortions created by particular covenants inherent in bond contracts (such as for example early call-features), iii) they allow for a more direct analysis of credit risk, i.e. the influence of interest rates, rather than the more indirect linkage of interest rate based securities such as bonds, and iv) the increasing harmonization of CDS contracts allows for a more direct comparison of cross country default risk. Nevertheless, as with every new financial instrument, credit default swaps remain an exotic instrument and disadvantages do exist, namely the rather thin liquidity in the overall credit derivatives market.

In this paper, we take advantage of an original database of transaction, bid, and ask data of credit default swaps to study the informational content of financial crises for assessing sovereign risk in the rest of the world. We do not address the issue of the information

provided by the crisis on the concerned country rates but rather the information on other countries (where the crisis did not occur but credit pricing changes may have occurred following the crisis). The idea stems from the strong literature that exists in contagion effects (Kodres and Pritsker, 2002). It is well known (and appears also in our data) that when Brazil goes through a crisis, the rest of the world's credit standing will be somewhat affected but that Latin America's credit standing will be affected relatively more. In this research, we do not address contagion issues directly. We are more interested in the overall informational and market impact of large financial crises on assessment of credit risk in the rest of the world. Our results show that sovereign risk pricing uncertainty rises after rather than before crises, that ratings find a new glory after crises (while other factors are used for pricing before crises), that demand for hedging sovereign risk rises strongly after crises, creating an imbalance in the markets but not necessarily leading to more transactions. We also document – somewhat surprisingly - a flight to quality in this market: this may seem surprising as the CDS instruments represent a market to hedge for quality. We document the higher informational content of transaction data versus quote data. Overall, everything tends to show that major financial crises may lead to a strong market uncertainty on how to price sovereign risk rather than to provide actual pricing information, and that this information uncertainty rises after rather than before the crisis itself. In that sense, crises are not a resolution of pricing uncertainty but rather give rise to pricing uncertainty themselves.

I. INTRODUCTION

The financial innovations of the late 1990s have led to the emergence of a significant amount of new instruments, in particular in the market for hedging credit risk. Credit default swaps (CDS) are the most popular specimen in the emerging world of credit derivatives. In recent years, much of the academic literature has focused on the theory on valuation issues of such instruments in the corporate case (Duffie (1998), Hull and White (2000)), but far less work has focused on empirical aspects (Cossin *et al.*, (2002), and Houweling and Vorst (2001)) and no work that we know of has looked at it as an indicator of sovereign risk information.

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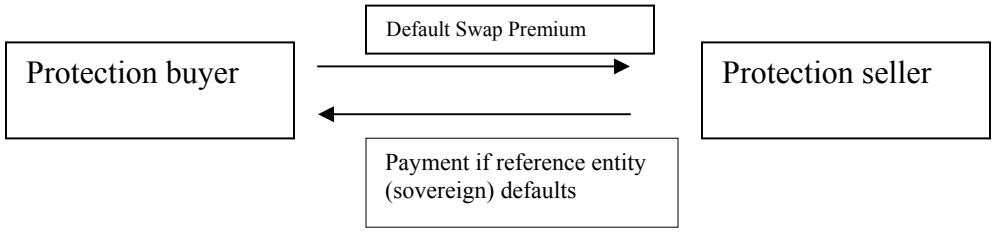

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[2] According to the ISDA, "credit event" definitions include bankruptcy, failure to pay, restructuring, repudiations/ moratorium, obligation default and obligation acceleration (Moody's 2001). The contingent amount is the difference between the face value of the bond and its market value and is paid at the time where the underlying bond defaults. The buyer of protection pays the annuity premium (or twice annually, or quarterly) until the time of the credit event of the maturity date, whichever is first. The term 'swap' is applicable to credit swaps because they can be viewed, under certain special circumstances, as a swap of a default-free floating rate note for a defaultable floating rate note. This is exactly the idea behind looking at the relation between bond spreads traded on the sovereign debt market and this rather innovative instrument to hedge sovereign default risk, incorporated by the credit default swap.

credit risk without having to finance it. One of the major features of credit derivatives is the allowance of the transfer of pure credit risk from one counterparty to another. Positively, credit derivatives have fostered to improve liquidity in the cash credit market by making it easier to access a diversified portfolio of names and, when desirable, actively 'short' credit risk. Moreover, the market does appear to be moving toward greater liquidity and diversification as more reference entities are actively traded.

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In this paper, we take advantage of an original database of transaction, bid, and ask data of credit default swaps to study the informational content of financial crises for assessing sovereign risk in the rest of the world. We do not address the issue of the information provided by the crisis on the concerned country rates but rather the information on other countries (where the crisis did not occur but credit pricing changes may have occurred following the crisis). The idea stems from the strong literature that exists in contagion effects (Kodres and Pritsker, 2002). It is well known (and appears also in our data) that when Brazil goes through a crisis, the rest of the world's credit standing will be somewhat affected but that Latin America's credit standing will be affected relatively more. In this research, we do not address contagion issues directly. We are more interested in the overall informational and market impact of large financial crises on assessment of credit risk in the rest of the world. Our results show that sovereign risk pricing uncertainty rises after rather than before crises, that ratings find a new glory after crises (while other factors are used for pricing before crises), that demand for hedging sovereign risk rises strongly after crises, creating an imbalance in the markets but not necessarily leading to more transactions. We also document – somewhat surprisingly - a flight to quality in this market: this may seem surprising as the CDS instruments represent a market to hedge for quality. We document the higher informational content of transaction data versus quote data. Overall, everything tends to show that major financial crises may lead to a strong market uncertainty on how to price sovereign risk rather than to provide actual pricing information, and that this information uncertainty rises after rather than before the crisis itself. In that sense, crises are not a resolution of pricing uncertainty but rather give rise to pricing uncertainty themselves.

The paper proceeds by first describing the dataset and analyzing transactions versus quotes as well as relationship of CDS rates to sovereign ratings. We then describe the three financial crises considered and investigate the changing impact of ratings after crises, the more salient elements of market changes as well as the information issues revealed by bid-ask spreads.

II. OUR CREDIT DEFAULT SWAP DATASET

The Credit Default Swap prices are obtained from a major inter-bank dealer in London. The dataset consists of:

- several thousand one-way quotes (total of 4028). One-way quotes represent the request to sell or buy a CDS at a particular price by the asking party
- 2097 two way quotes, each of them with a bid-ask spread
- 314 actual transaction data. The traded data is cleared market data and represents the fact that the actual transaction took place. These prices can be considered as fair prices since they represent the mutual agreement from the buyer's view, i.e. his willingness to pay, and from the seller's view, representing his willingness to receive the swap rate payment.

The prices of the CDS are denoted in basis points per annum. The notional amount for the contracts range from USD 1 to 50 Mio. The major part of the CDS data has a maturity of five years, within a total range of one to ten years.

The structure of the CDS market for sovereigns can be seen from table 1. Given this relatively exotic, new financial derivative, it seems from the data that the major 'players' in this market are mostly well-established banking institutions, a fact confirmed by Beattie (2000). The latter author emphasizes the major role of internationally operating banks and security firms in the OTC-market, those institutions taking up the bulge of the market. Given this, we will not consider here the possible implications of counter-party default risk (see Duffee and Zhou, 1999). Indeed, the top three counterparties were all ranked AA or better. This is a result that holds generally for the credit derivatives market, where counterparty risk is heavily concentrated among top tier banks (Fitch, 2003).

Table 1. The ten major counterparties involved. This table summarizes the most frequent counterparties (on both bid and ask side) in our credit default swap dataset, as well as the underlying ratings of the institutions.

Institution	Rating
Deutsche Bank	AA
General Re	AAA
JP Morgan	AA
Lehman	A
Merrill Lynch	AA-
Paribas	A-
Rabobank	AAA
Salomon Bros (Citibank)	A
Société Générale	AA-
UBS	AA+

The dataset under study here spans from the time period of June 1997 until February 2000. It encompasses some of the major financial crises that occurred in the 1990s, such as the South-East Asian turmoil in October 1997, the Russian default in mid-August 1998 and the Brazilian devaluation in January 1999. Table 2 shows the distribution of our dataset over time, dividing the transactions, one- and two-way quotes in the months occurring.[3]

Table 2. Distribution of our total dataset over time. We divide our dataset according to transactions data, one- and two way quotes, as well as the ratio of bids and asks on a monthly basis.

Year	Month	Transactions	2-Way Q	1-Way Q (Bid)	1-WayQ (Ask)	Ratio Bid/Ask
1998	January	13	10	5	6	0.83
	February	2	54	42	36	1.17
	March	2	29	10	38	0.26
	April	9	48	41	76	0.54
	May	12	30	38	36	1.06
	June	18	64	76	50	1.52
	July	18	105	105	141	0.74
	August	22	70	84	62	1.35
	September	22	82	115	102	1.13
	October	9	75	73	126	0.58
	November	16	74	68	179	0.38
	December	5	80	67	72	0.93
1999	January	21	132	138	131	1.05
	February	13	65	72	132	0.55
	March	6	103	57	121	0.47
	April	15	113	80	123	0.65
	May	10	72	63	84	0.75
	June	10	124	82	79	1.04
	July	19	140	99	102	0.97
	August	12	143	102	135	0.76
	September	23	150	90	127	0.71
	October	11	82	77	87	0.89
	November	5	69	62	71	0.87
	December	4	52	14	28	0.50
2000	January	11	63	21	93	0.23
	February	14	56	33	43	0.77
	Total	322	2085	1714	2280	-
Total	Average p.m	12.4	80.2	65.9	87.7	0.80

[3] We did not include the data-entries for the months at the end of 1997, given the very few data points available.

A. The Informational Content of Transactions versus Quotes

A major issue that arises in our study is how to use quote information versus transaction information. Most academic studies working on credit risk or sovereign risk tend to work from quotes, as quotes are more readily available and lead to much larger sample sizes usable for econometric tests than transaction data. The advantages of looking at sovereign risk is that - when available, and stripped of other influences such as specific features such as call features or guarantees - bond spreads are a good alternative measure to CDS rates (see Chan-Lau, 2003; Singh, 2003). We thus look at the relationship between CDS rates and bond spreads and see whether CDS rates quotes or transactions relate differently to spreads. In order to do so, we regress – via simple OLS estimation– the transaction, two- and one way quotes (both for bids and asks) of the CDS data available on the corresponding country stripped bond spreads, as supplied by JP Morgan[4]. The equation thus estimated is:

$$CDS = \alpha + \beta * CountrySpread$$

Intuitively, we would expect to find a very high explanatory power of this simple regression, as both the CDS rates and the bond spreads should reflect the pure sovereign credit risk of the underlying country. This explanatory power – as reported by the R^2 - should be higher for transaction data than for quotes, reflecting the higher informational content in sovereign CDS data. The results are reported in table 3.

The bond spread data are spreads on sovereign bonds denominated in US Dollars from the Emerging Market Bond Index (EMBI) and the EMBI+ index from JP Morgan. This is daily, contemporaneous data, and the results show the regressions of the CDS rates and the corresponding bond spreads for each country. The sovereign spread of a country's foreign debt is the spread above the US treasury spot curve that equates the discounted scheduled payments on the country's debt with the market price of the sovereign bond. We abstract from the complication of market expectations about trends in the exchange rates of the dollar and other major currencies. JP Morgan, one of the major dealers in this market, constructs a value-weighted index of all emerging market sovereign indexes, called the Emerging Market Bond Index (EMBI), and computes the corresponding spreads. JP Morgan supplies 'stripped' spreads, i.e. net of enhancements which are typically on principal payable at the end of 30 years plus on interest for up to 18 months, and the collateral set aside for these enhancements makes the risk of some of these instruments a mixture of pure country risk, zero credit risk on the US Zero Coupon used as the risk free reference and other assets used for collateral. The stripped spreads for the individual countries supplied from JP Morgan are calculated by removing the influence of these enhancements, in order to capture the pure country risk.

While heavy overall as a methodology, this analysis leads to a lack of data for the crises event study, at the heart of the present paper. Nonetheless, it allows us to address a major

[4] We would like to thank Alvin Ying for supplying us with the data for countries' bond spreads.

issue, one often mentioned in the academic literature but seldom truly addressed: whether the information inherent in quotes is as good as the information content of transactions. In order to answer this question, we look at the information content inherent in our country regressions, and compare the results of those regressions between transactions, one- and two-way quotes.

Table 3. Summary of regression of transactions, two and one way quotes and the correponding country spreads. The CDS transaction, two- and one way quotes for each of the countries are regressed on the individual country EMBI-bond spreads from JP Morgan. The OLS regressions are done over the whole sample period for the dataset. The second column represents the total number of observations for each of the individual countries.

Country	Transactions		Two Way Quotes (Bids)		Two Way Quotes (Asks)		One Way Quotes (Bids)		One Way Quotes (Asks)	
	R^2	No. of observations	R^2	No. of observations	R^2	No. of observations	R^2	No. of observations	R^2	No. of observations
Argentina	0.91	8	0.65	81	0.65	81	0.56	39	0.63	48
Brazil	0.72	11	0.83	86	0.82	86	0.87	33	0.90	25
China	0.48	82	0.32	348	0.34	348	0.45	263	0.35	556
Mexico	0.90	9	0.59	104	0.62	104	0.52	50	0.75	68
Philippines	0.90	19	0.73	117	0.74	117	0.74	148	0.80	153
South Africa	0.35	6	0.37	19	0.14	19	0.33	45	0.61	44
Thailand	0.95	15	0.87	85	0.84	85	0.89	85	0.84	148
Turkey	0.19	3	0.59	35	0.62	35	0.53	57	0.70	68

The results shown in the table above indicate that for all countries where the number of transactions is large enough (larger than 15 here), the R^2 is higher for transactions data, compared to both one - and two way quotes, but the R^2 is similar for the two-way and one way quotes. When transactions are not numerous, it is not obvious whether quotes provide correct information (see Mexico). The informational content of transactions data appears more significative than for quotes, and having two way information does not necessarily add much information. Because of this property of transaction data, we will study the impact of financial crises on these transaction data first, and then analyze imbalances between bids and asks and finally at the impact of the crises considered on bid-ask spreads, as all provide information to the market.

B. The Relationship between CDS Rates and Sovereign Ratings

We have determined that transaction data are preferable for pricing purposes to quote data. Because of data restrictions, it is often easier to use ratings rather than bond spreads as a main source of default risk information. In a first step, we want to test for the influence of credit ratings and the credit default swap rate. Ratings on sovereigns contain important public information on the sovereign risk of a country, and rating changes have a significant effect on the prices of outstanding debt (Cantor and Packer, 1996). Therefore, a strong relationship between ratings and credit default swap rates is to be expected. We investigate it on our overall sample in order to be able to assess later the impact of financial crises on the CDS rate - rating relationship.

Intuitively, the relationship between credit default swap rates and ratings should be of a non-linear character. Ideally, in order to get a more precise shape of the relationship, we would directly implement and test a model - however, such a theoretical framework, already rare in the case of credit derivatives for corporates, is virtually non-existent for sovereigns, with no current agreement on what model would perform best. We thus proceed here in a first step with a simple analysis (as this is not the center topic of the study). We estimate linear, semi log and power relationships. In the power test, we fit for the curvature of the relationship while imposing it on both the linear and semi-log regressions. We thus give quite some flexibility to the shape of the swap rate/ credit rating relationship. In brief, in the power regressions, we check for the relationship of the following type:

$$CDSR = \alpha Rating^{\beta}$$

where β is capturing the shape of the relationship. We can write this equivalently to:

$$\ln(CDSR) = \ln\alpha + \beta * \ln(Rating)$$

The regressions for the semi-log tests are of the form:

$$\ln(CDSR) = \alpha + \beta * Rating$$

and for the linear test, the specification is:

$$CDSR = \alpha + \beta * Rating$$

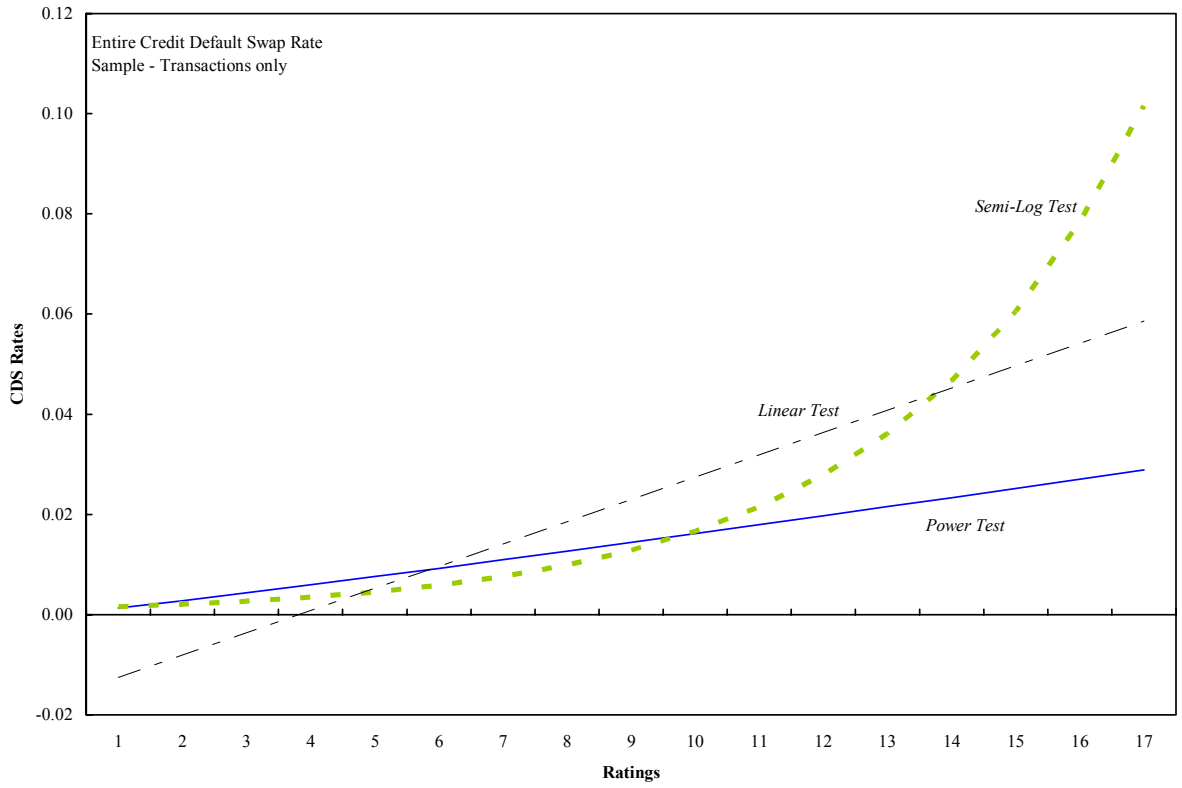
In table 4 we show the results of the semi-log, linear and power tests on transactions data only (Figure 1 illustrates the shapes thus obtained). The whole time span of the dataset, November 1997 until February 2000, is used.[5]

[5] There are 314 data points for the transactions in our sample.

Table 4: Regression results of CDS rates and Ratings. Results show Semi-Log, Linear and Power Tests of CDS transaction data on total ratings. There are a total of 314 transaction data points in our sample.

	Relationship CDS rates and Ratings		
	Dependent Variable: CDS rates (Transaction Data)		
	Semi-Log Test	Linear Test	Power Test
Coefficient	0.26	0.004	1.1
t-statistic	19.33	11.3	16.67
R-squared	0.54	0.29	0.47

Figure 1. Best fit of semi-log, linear and power regression on entire CDS sample. The figure below shows the results of the best fit of the power, linear and semi-log test of CDS transaction data on the corresponding ratings.



The semi-log test provides by far the better fit. Overall, more than half of the variance in default swap rates can be explained simply by the corresponding rating. One can thus confirm that there is some strong relationship between ratings and CDS rates, best described in our simple framework by a semi-log relationship. How this relationship is affected by financial crises is one of the topics of this study, as it addresses part of information dissemination in financial markets during crises.

III. THE THREE CRISES EPISODES CONSIDERED

As mentioned before, our dataset comprises roughly three years, starting in June 1997 and ending in February 2000. During this time span, the major global financial events with respect to payment difficulties by sovereign countries can be summarized as follows:

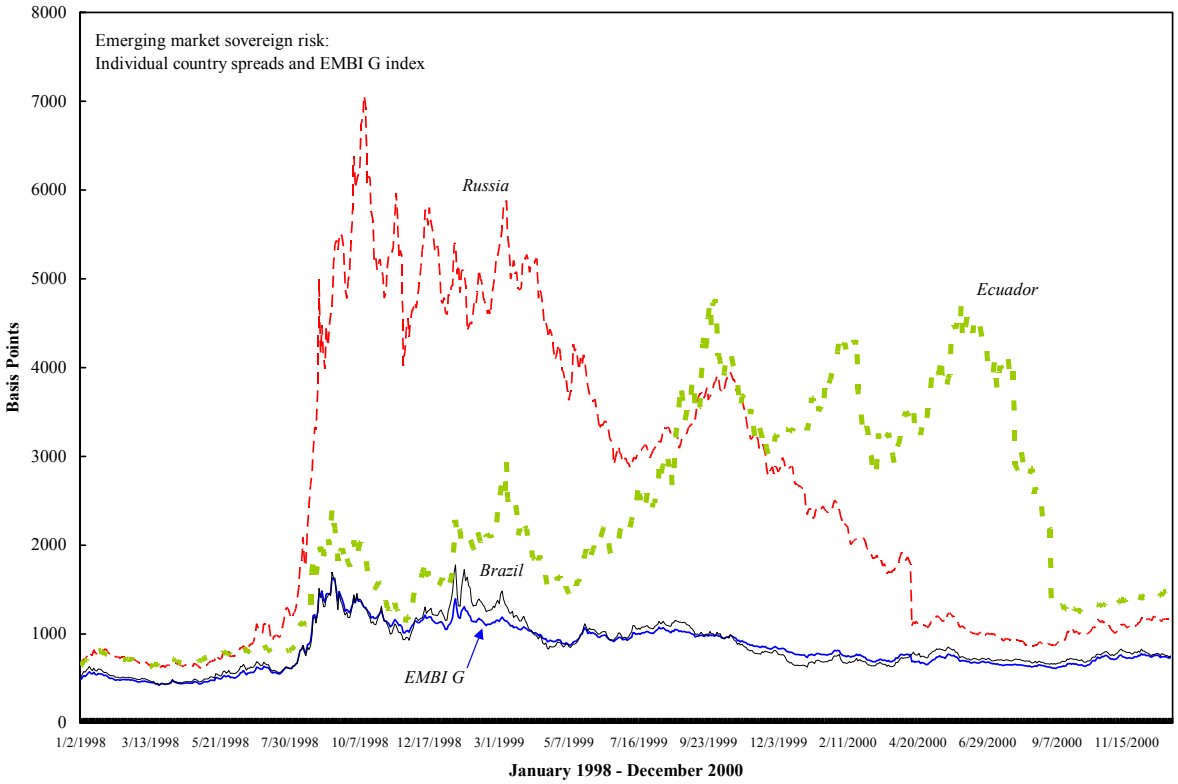
- The devaluation and debt restructuring of the Russian Federation in August 1998
- Brazil's devaluation and financial collapse in early January 1999
- The remarkable default of Ecuador on its outstanding Eurobonds in September 1999 - the first country ever to default on its Brady bond obligations. While in some regard a more minor crisis to the rest of the world than the Russian and the Brazilian crises, the Ecuador crisis is a useful benchmark in our study to check whether smaller crises have qualitatively similar impact to larger ones (or whether crises impact require a threshold crisis size).

Furthermore, the South-East Asian Crisis, with the attack on the Thai Baht in the summer of 1997, and on the Hong Kong dollar on October 17, 1997 borders our sample period. Nonetheless we lack corresponding data points and we do not investigate it. We should also note the financial restructurings of Pakistan (November 1999) and the Republic of Ukraine (February 2000). These two events were minor with respect to the international scene (both were resolved quickly with exchange offers) and are not directly studied here.

A. Economic Background to the Three Crises under Study here

We hereby give a summary of the economic context of each crisis before considering information issues during the crises themselves. Figure 2 shows the evolution of emerging market sovereign spreads during the overall period.

Figure 2. Emerging market sovereign spreads for Russia, Brazil and Ecuador. The figure below shows the EMBI Global index of JP Morgan measuring aggregate sovereign risk in Emerging markets, as well as the individual country spreads of Russia, Brazil and Ecuador from January 1998 to December 2000. The spreads are expressed in Basis Points.



- **The Russian Default dated August 17, 1998**

On August 17, 1998, Russia announced a combination of debt restructuring, devaluation and moratorium on private principal repayments. Russia had been downgraded first by Moody's in March 1998, and then by all three major agencies in May and early June.

The newly founded Russian Republic ran throughout the 1990s large budget deficits, which implied steadily higher debt servicing costs. The main feature of domestic debt was its short-term character, which strengthened the governments' need to raise permanently new capital in order to serve its debt obligations. The dangerous height of the budget deficit was aggravated by difficulties for the central government to collect revenues (mainly a problem of raising taxes). The macroeconomy also experienced a huge contraction: GDP fell by 33% in the years from 1993 until 1998 (IMF, 1998). Domestic banks started to borrow aggressively overseas and used those funds to buy high-risk domestic bonds with high expected yields - a strategy which exposed the banking system to increasing sovereign credit risk (see Duffie *et al.,* 2002). By October 1997, oil prices, representing one of Russia's main exports, declined steadily until 1998, a situation which deteriorated the current account further throughout the first half of 1998. By mid-1998, the external terms of trade had

deteriorated to unsustainable levels of 18% on a year-to-year basis. Concerning the external debt structure in the upfront of the coming crisis from March until July 1998, there was a large accumulation in the outstanding stock of Russian Eurobonds, namely by non-residents who had started piling up high-yield Ruble denominated domestic securities (such as GKO's and OFZ's) and other Russian debt instruments.

On top of the old, restructured Soviet-era debt that the Russian Federation took over, Russia built significant amounts of new debt in order to finance its increasing budget deficits. The latter were notably financed by the issuing of Ruble denominated Treasury bonds (GKOs and OFZs), which reached by mid-1998 a total amount of USD 70 Billion, one third of which being held by foreigners (IMF, 1998). Starting in 1993, the so-called 'MinFins' - dollar denominated bonds issued as payments to Russian exporters on the account of domestic banks - were increasingly sold to foreigners[6]. In 1996, Russia issued its first Eurobond (several others were issued in 1997-98) in various currencies, with implicit cross-default triggers.

On August 17, 1998, Russia announced a compulsory restructuring of the domestic debt (GKO and OFZ), and a 90-day moratium was placed on foreign commercial debt, and the currently existing exchange rate band was abandoned. At this time, it was unclear whether Russia would also default on its external, sovereign debt.

What was the market's perception of the default probability of a Russian non-payment during that period? Merrick (2001)[7] shows that during the crisis, the implied default probability on Russian debt rose sharply during the week prior to the GKO default announcement, and continued to rise once the crisis erupted. In order to assess the relevant default probabilities[8], he divides his 6-month sample period into a pre-GKO default sample period - ranging from July 1998 until August 14, 1998 - and one for the post-GKO sub-sample period, from August 17 until December 14, 1998. He finds a significant structural break occurring in the probability of default at the particular crisis date (August 17, 1998). On the particular day of the announcement, the base default rate jumped overnight to nearly 40%, its average value until the end of the sample period. Duffie *et al.* (2002) find that the price of the 'MinFin' bonds – dollar denominated bonds, that are explicitly recognized as an obligation of the Russian Federation - fell by approximately 80% during the week of the Russian default, suggesting that market participants were indeed surprised by this credit event right up to the event itself happening. According to the authors, after the default announcement on August 17, 1998, bond prices reflected investors' expected payment at maturity, and investors'

[6] Ministry of Finance bonds ("Min Fin's") are dollar denominated bonds that are explicitly recognised as an obligation of the Russian Federation. Approximately U$ 7.9 bn of Min Fin bonds were issued in May 1993 as compensation to enterprises whose dollar accounts at Vnesheconombank had been frozen at the end of 1991.
[7] Merrick (2001) extracts the (adjusted, risk neutral) default probability term structure and the implied recovery ratio of the market for outstanding Emerging Market bonds during the Russian GKO default crisis in August 1998.
[8] His sample period for the five Russian Eurobonds ranges only from July 1998 until December 1998.

expectations were subsequently revised upwards over time toward one-third of face value as market and economic conditions changed.

- **The Brazilian Devaluation: January 13, 1999**

By the end of 1997, Brazil's combination of overvalued currency, loose fiscal policy and tight money supply had resulted in large and growing public-sector deficits and a big hole in its current account. The government pushed interest rates to very high levels and announced important fiscal squeezes. In November 1998, the country won a large IMF-led bailout package of the size of 3% of GDP, tied to emergency measures such as tax increases and spending cuts, with the goal of reassuring investors that a devaluation would not be undertaken. However, investors became convinced that a devaluation was under way. Between August 1998 and January 1999, Brazil experienced important capital outflows, as first foreign and then local investors pulled out. To make matters worse, a local governor proclaimed a moratorium on that province's debt, putting the country's fiscal efforts into terminal doubt. Brazil announced on January 13, 1999 the official devaluation of its currency, the Real. This brought about a real depreciation of 35% of the currency in the eight weeks following that event, and the recession that was already under way deepened.

The macro-economy for Brazil had a gloomy outlook: with GDP stagnating at its previous level, the balance on the current account went into negative by USD 35bn in 1998, from its similar previous level of USD 30bn. Inflation, which had record low levels after the introduction of the Real in early 1994, started to rise once again, and Brazil was facing a serious battle to regain the confidence of the financial markets again. Fears that the government might default on debts had receded but not disappeared, even after two months of the outbreak of the crisis.

International banks aggressively cut credit lines to their local operations in Brazil and prepared for a possible coerced rollover of inter-bank debt (as happened in Korea before) by also reducing holdings of domestic debt. Following the devaluation of January 12, 1999, a key macroeconomic uncertainty had been resolved. In the weeks leading up to the mid-March voluntary agreement (formalized on March 31, launched together with a strengthened IMF arrangement) between international banks and the government to maintain exposures at end-February levels for six months, rollover ratios stabilized at a high level. By April 1999, there were strong indicators that the Brazilian economy was on track for recovery in the absence of a systematic banking crisis after the devaluation in January, and as most local commercial banks recorded record first quarter profits, some international banks started to increase their exposures above what was required under the agreement.

- **Ecuador Brady Bond Default: September 28, 1999**

The small Andean nation of Ecuador missed the payment of USD 500mio of Eurobonds in September 1999. Thus, on September 28, 1999, Ecuador became the first sovereign to

officially default on Brady bonds after the expiration of a 30-day grace period. It can be argued that the crisis had been long in the making and reflected internal political problems aggravated by external shocks, such as the 'el nino' hurricane. At the time of the default, Ecuador's external bonded debt consisted of collaterized Brady's, Par- and Discount Bonds, with an outstanding amount of USD 3.1bn, un-collaterized Brady (past-due interest, PDI's) amounting to USD 2.8 billion, and a stock of USD 0.5 billion of dollar denominated Eurobonds. Markets were aware of the increasing risk, as reflected by the high secondary market spreads. However, although the Ecuadorian default was seen by investors as a test case for the future approach of private sector involvement into bond restructuring, the effects of Ecuador's default were effectively ring-fenced as its importance in many emerging market investors portfolios was small - Ecuador's weight in JP Morgan's EMBI+ index is merely 1.2%. After the rather successful dollarization program and the potential three year USD 2 Billion loan package provided to Ecuador by the financial community, more positive momentum emerged.

IV. The Changing Impact of Sovereign Credit Ratings on CDS-Rates After Crises

In line with the previous analysis, we test whether the influence of credit ratings on the credit default swap prices varies before and after the financial crises identified above. For this, we define for each of the Russian, Brazilian and Ecuadorian crisis a three-month window period before and after the crisis. We regress CDS-rates of all sovereigns, excluding the country considered, on the rating of the corresponding sovereign before and after the crisis. The regressions are estimated separately for the crises windows before and after each crisis, and are pure cross-section estimations. Like most analysts who transform bond ratings into data for regression analysis (Cantor and Packer, 1996), we assign numerical values to the Moody's and Standard and Poor's ratings. This can easily be done, since every Moody's symbol has its counterpart in Standard and Poor's rating scale, and this correspondence allows us to compare the sovereign ratings assigned by the two agencies[9] (see also Cantor and Packer, 1996). This simple technique reveals how much explanatory power sovereign ratings have before and after the crisis. While these rough results are refined underneath (by controlling for quality changes for example), results seem solid: for major crises, ratings explain more just after the crisis than just before, and by a large amount. At the same time that their explanatory power has increased tremendously, their relationship to the rates (as found in the coefficient of the regression) is not changed: everything is as if the pricing model that was there before is still valid but that ratings are suddenly more considered in that pricing model.

- Tables 5, 6 and 7 give the regression results centered around crisis time (3months window before and after) for the Russian, Brazilian and Ecuadorian crises.

[9] In particular, we assign to AAA/Aaa = 1, and so on,through CCC/C=17.

Table 5. Russian Crisis Three months windows centered around the crisis date.

	Three Months Before Crisis Window			**Three Months After Crisis Window**		
	Dependent Variable: CDS rates (Transaction Data)			*Dependent Variable: CDS rates (Transaction Data)*		
	Semi-Log Test	Linear Test	Power Test	Semi-Log Test	Linear Test	Power Test
Coefficient	1.2	0.23	0.0055	1.24	0.3	0.00738
t-statistic	4.42	4.2	3.62	7.945	8.55	5.63
R-squared	0.28	0.26	0.21	0.58	0.61	0.41

Table 6. Brazil Crisis Three months windows centered around the crisis date.

	Three Months Before Crisis Window			**Three Months After Crisis Window**		
	Dependent Variable: CDS rates (Transaction Data)			*Dependent Variable: CDS rates (Transaction Data)*		
	Semi-Log Test	Linear Test	Power Test	Semi-Log Test	Linear Test	Power Test
Coefficient	1.045	0.25	0.0047	1.034	0.27	0.0039
t-statistic	6.78	7.67	4.59	11.2	14.48	6.78
R-squared	0.58	0.64	0.39	0.78	0.86	0.57

Table 7. Ecuador Default

	Three Months Before Crisis Window			Three Months After Crisis Window		
	Dependent Variable: CDS rates (Transaction Data)			*Dependent Variable: CDS rates (Transaction Data)*		
	Semi-Log Test	Linear Test	Power Test	Semi-Log Test	Linear Test	Power Test
Coefficient	1.31	0.31	0.0058	1.39	0.3	0.005
t-statistic	6.61	10.54	6.3	4.17	6.25	5.22
R-squared	0.48	0.7	0.45	0.42	0.62	0.53

In both major crises, the impact of ratings on default swap rates becomes much stronger after crises. All occurs as if ratings information becomes suddenly more important around crises. This is not explained by a sole change of ratings as confirmed later in the study. This information diffusion is the heart of this study. The relatively minor Ecuadorian crisis, where no such impact appears, confirms that crises need to be major for ratings to be considered with a new eye by the markets.

Interestingly, the relationship between ratings and cds rates does not seem to change (i.e. the coefficient in the above regressions does not seem to change significantly before and after crises). This is confirmed statistically in Table 8. We define a dummy variable D (D=0 before crisis, D=1 after crisis), and regress the (log of) CDS rates on the dummy, the log of ratings and interact the dummy with the ratings - the significance of this interaction term will tell us if ratings will have an effect on the prices of CDSs. In particular, the regressions take the form:

$$\log(CDSR) = \alpha + \beta * Dummy + \gamma * Ratings + \theta * Dummy * Ratings$$

Table 8. Results of Semi Log test of regression of the (log of) CDS rates on the dummy, ratings, plus an interaction of ratings and dummy. The dependant variable is the CDS rate. The table shows the results for the Russian, Brazilian and Ecuadorian regressions.

	Semi-Log Test for Russia			**Semi-Log Test for Brazil**			**Semi-Log Test for Ecuador**		
	Dependent Variable: log(CDS)			*Dependent Variable: log(CDS)*			*Dependent Variable: log(CDS)*		
	Coefficient	t-statistic	Prob.	Coefficient	t-statistic	Prob.	Coefficient	t-statistic	Prob.
Constant	-6.43	-13.53	0.00000	-6.28	-26.28	0.00000	-7.41	-22.7	0.00000
Dummy	0.087	0.15	0.00000	-0.099	-0.311	0.75600	-0.056	-0.11	0.92000
Ratings	0.23	4.39	0.00000	0.252	9.5713	0.00000	0.31	9.4	0.00000
Dummy* Ratings	0.062	0.97	0.88140	0.023	0.612	0.54020	0.0096	-0.0181	0.86000
R-Squared	*0.47*			*0.75*			*0.67*		

As reported in table 8, the coefficient of the interaction Dummy*Ratings variable is not significant for all three crises considered. Ratings thus become more important in the pricing but pricing remains the same (i.e. pricing models would not change, but the ratings impact becomes more significant).

Interestingly, the large improvement in explanatory power of ratings seem to happen at the transaction level rather than at the bid or the ask level. While these seem more related to ratings after the crisis than before the crisis, the improvement is not comparable as to the change for transaction data (e.g., for the Russian crisis, the R^2 of the two-way bid on ratings goes from 41% to 51%, from 40% to 53% for two-way asks, from 57% to 63% for one-way bids, and from 50% to 75% for one-way quote asks. For the Brazilian crisis, the R^2's of the 2 way bid goes from 57% to 61%, of the 2-way ask from 58% to 60% and R-squares go down for the one way bid and ask rates). Detailed results are not reproduced here but are available from the authors. There is no clear asymmetry between bid or ask improvements either so that it cannot be clearly said whether the market is truly moved by the buyer of protection or by the sellers of protection during crises.

This result is in line with what many practitioners have indicated about this rather exotic market: the true information is aggregated at transaction level, but not necessarily at the quote level, which tends to be "indicative", meaning not necessarily close to realization.

To conclude, the most fundamental result of this section is that after crises, ratings become suddenly more important[10]. The shape of their relationship to CDS rates (value of the coefficient) is not affected but ratings suddenly explain much more of the variation in rates. All appears as if, suddenly, after crises, market participants pay more attention to ratings than It is not that ratings provide new information. It seems that participants may have paid attention to other factors before the crisis that suddenly are ignored in favor of the rating after the crisis. Because there is no impact on coefficients, these factors seemed to be uncorrelated to rating information. While the pricing of CDS rates evolves as described here, we may wonder how the market is transforming itself around financial crises. This in itself will further illuminate the transmission of information (or lack thereof) of financial crises.

V. How does the Sovereign Credit Market Change around Crises?

A. Flight to Quality after Crises

As shown in table 9, during major crises, there seems to be evidence of flight to quality, even in the CDS market, i.e. in the market for insuring sovereign underlying[11]. This seems to be an interesting and somewhat paradoxical finding. Generally, flight to quality of investors is a well-known pattern during financial crises. Indeed, this is a particular paradigm of the financial episodes of the 1990s, where investors flee countries with seemingly unrelated fundaments, and redirect their funds towards safer assets (Kodres and Pritksker, 2002). The credit derivative market, however, is a special market, that was namely created to hedge against credit problems, offering participants the possibility to particularly hedge against low-rated underlyings. Therefore, one could have expected investors to hedge increasingly in relatively low-rated (i.e. higher-risk) issuers, and this could occur in the CDS market. Thus, *inter alia*, one could have assumed that, either because of increased awareness or higher risk aversion, there would be more of the market going towards 'higher risk' (i.e. lower-rated) transactions, with the implication that market participants - due to higher risk aversion - would shift towards hedging in lower-rated sovereigns. Interestingly, the opposite is

[10] The problem of reversed causation might raise as an issue here, i.e. ratings are changed as a function of the CDS rates. We believe, however, that this is not the case, since the credit derivate market is still relatively new in the financial landscape, and rating agencies do not (yet?) seem to take into account CDS rates when sovereign ratings are given or indeed modified (see Fitch, 2003).

[11] In table 9, lower values for ratings, as observed in the Russian and Brazilian case, imply that ratings are biased towards higher-rated issuers (with Aaa/AAA-rated sovereigns, for example, being assigned the numerical value of 1). This implies the flight to quality mentioned in the text.

observed in the two major crises we examine, namely Russia and Brazil[12]. The evidence reported here (see table 9) seems to suggest that the CDS market seems to shift towards higher-rated underlyings. This shows the phenomena of flight to quality, which confirms the stylized fact in other asset markets[13].

Table 9. Change in Ratings before and after crises. The table below shows average Ratings as well as its standard deviation before and after a three month crisis window, centered around the crisis date, for respectively the Russian, Brazilian and Ecuadorian Crisis.

	Russia		**Brazil**		**Ecuador**	
	Before Crisis	After Crisis	Before Crisis	After Crisis	Before Crisis	After Crisis
Ratings (Average)	8.75	8.1	8.24	6.94	9.5	9.5
S.E.	2.5	3.6	3.88	3.86	244	2.75

We next move to a deeper analysis of this issue by looking at demand-supply balances.

B. The Demand and Supply for Sovereign Credit Hedging before and after Financial Crises

In this section, we study the effects of crises on the number of bids, asks and transactions of credit default swaps. In particular, we address the following questions: Is there more demand for sovereign credit hedging before or after the crises? Are there more CDS transactions before, during or after crisis? When there are quotes, do we get to deals – that is to say actual transactions observed - more easily before or after?

For this, we define three months windows before the crises occurring in Russia, Brazil and Ecuador, and look at Transactions as well as one-, and two-way quotes.

[12] There is no change in ratings observed for the relatively minor crisis, Ecuador, where dealings remain at the same ratings class.

[13] Again, this might seem surprising, since the CDS market, a pure sovereign credit risk market, exists for hedging particularly risky underlyings, and one might have assumed ex ante that investors would shift towards higher-risk credit derivatives. This is not supported by the reported data above, where the evidence suggests that investors proceed to 'flight tow quality', i.e. higher-rated (lower-risk) CDSs.

Table 10. Summary of Total Dataset. The table shows the total number of transactions, two and one way quotes. Also, the ratio of transaction data to quotes are shown. This is done for each of the three crises under study here for a three months before and after crisis window.

	Russia		**Brazil**		**Ecuador**	
	Before Crisis	After Crisis	Before Crisis	After Crisis	Before Crisis	After Crisis
No. Transactions	52	48	35	37	49	26
No. Two Way quotes (Bids & Asks)	222	220	262	270	439	227
No. One Way quotes (Bids)	238	265	213	239	288	166
No. One Way quotes (Asks)	242	168	403	360	361	203
Ratio Transactions/Bid Two Way Quotes	*0.23*	*0.22*	*0.13*	*0.14*	*0.11*	*0.11*
Ratio Transactions/Bid One Way Quotes	*0.22*	*0.18*	*0.16*	*0.15*	*0.17*	*0.10*
Ratio Bid Two Way Quotes/ Bid One Way Quotes	*0.93*	*0.83*	*0.93*	*1.13*	*1.52*	*0.93*
Ratio Bid One Way Quotes/ Bid Two Way Quotes	*1.07*	*1.20*	*0.81*	*0.89*	*0.66*	*0.73*
Ratio Bid/ Ask One Way Quotes	*0.98*	*1.57*	*0.53*	*0.66*	*0.80*	*0.82*

Following a major credit event such as the Russian default in summer 1998, Table 10 shows that the demand for credit hedging increases: we remark a notable increase in the demand for Credit Default Swaps, as reflected by the bids of non-transactions data.[14] The number of bids – reflecting higher demand for credit hedging - increases, both for one- and two way quotes[15], whereas the number of actual transactions remains constant or even decreases. Note that the increase in demand occurred even before the actual default, and that the imbalance resolved itself within six months after the crisis erupted. While this had no impact on the direct relationship between these quotes and ratings, as reported above, it certainly should

[14] This result is strongly confirmed for an enlarged window of six months surrounding the crisis period.

[15] See in particular the third and very last row in table 10.

have an impact on where transactions are achieved. Notice also that there is a definite decrease in the asks – reflecting the willingness to offer (i.e. take on or supply) credit risk - once crisis occurred (see fourth row in Table 10).

An explanation of these results may reflect a change in the psychology of markets: a major financial crisis creates heightened risk-awareness among investors, and thus the demand for credit hedging instruments increases. Investors may be less weary of this credit hedging before a financial crisis.

We notice a similar, but less pronounced, effect for the case of the Brazilian crisis at the beginning of 1999, but to a lesser extent. The relatively minor Ecuadorian default did not affect the markets in similar ways.

VI. DO CRISES REVEAL NEW INFORMATION TO THE WORLD OR SIMPLY INFORMATION UNCERTAINTY?

At this stage, we focus on the uncertainty that exists about CDS pricing during major financial crises. Do crises bring a resolution of information uncertainty - basically provide new information on actual levels of credit risk, reflected in the new pricing more based on ratings? Or do major financial crises bring more pricing uncertainty to the markets? Indeed, as ratings become more powerful at explaining CDS rates during and after crises, one may wonder if crises are simply a resolution of information. If that is the case, one would expect lower spreads after crises than before. Of course, bid-ask spreads are also affected by the quality of the underlying sovereign[16]. We thus investigate the impact of crises on bid-ask spreads when controlling for quality.

In order to test for the above hypotheses, we proceed as follows. We define three month windows centered around each crisis date, and three months 'outside' windows (months –6 to –3 and +3 to +6). We then run the following regressions:

$$\log(B\_A\_Spread) = \alpha + \beta * Dummy + \gamma * Ratings + \theta * Dummy * Ratings$$

We regress the log of bid-ask spreads on ratings, and define a dummy variable which is = 0 before the crisis and 1 after the crisis. The interaction between the dummy variable and ratings will be an indication of whether bid-ask spreads – when controlling for quality (i.e. per rating class) – will increase or not after financial crises.

The regression results in table 11 provides clear results concerning the Russian crisis. When controlling for quality, spreads increased significantly after the Russian crisis[17]. This appears

[16] This means that bid-ask spreads can be expected to be different for high-quality (low risk) underlyings (such as for example Aaa/AAA rated sovereigns) than for higher risk countries.

[17] See also Appendix I. The mean for bid-ask spreads increases after crises, and this generally irrespective of the ratings class considered.

in the statistical significance of the interaction variable (dummy*ratings). While CDS rates are not affected quantitatively by this interaction variable (i.e. the pricing of ratings does not change with the rating) the bid-ask spreads are truly affected. Thus the crisis did not come as a resolution of information uncertainty but rather as a new addition to uncertainty to valuing sovereign risk world-wide. The cumulative over 6 months before to 6 months after leads to a coefficient that is strongly significant both statistically and economically.

Table 11. Russia. Regression results of semi-log test of bid-ask spread on ratings, during three month windows centered around the crisis date, and three month outside window (months –6 to –3 and +3 to +6). Dummy= 0 before the crisis and 1 after the crisis.

$$\log(B\_A\_Spread) = \alpha + \beta * Dummy + \gamma * Ratings + \theta * Dummy * Ratings$$

Three Month Around the Crisis Window				**Three Month Outside Crisis Window**			
Dependent Variable: log(B_A Spread)				*Dependent Variable: log(B_A Spread)*			
Variable	Coefficient	t-statistic	Prob	Variable	Coefficient	t-statistic	Prob
Constant	-7.91	-47.09	0.00000	Constant	-8.44	-27.62	0.00000
Dummy	-0.08	-0.36	0.71780	Dummy	0.32	0.99	0.32140
Ratings	0.18	9.76	0.00000	Ratings	0.23	7.37	0.00000
Dummy*Ratings	0.06	2.37	0.01840	Dummy*Ratings	0.04	1.27	0.20380
R^2	0.44			R^2	0.56		

Table 12. Brazil. Regression results of semi-log test of bid-ask spread on ratings, during three month windows centered around the crisis date, and three month outside window(months –6 to –3 and +3 to +6). Dummy= 0 before the crisis and 1 after the crisis.

$$\log(B\_A\_Spread) = \alpha + \beta * Dummy + \gamma * Ratings + \theta * Dummy * Ratings$$

Three Month Around the Crisis Window				**Three Month Outside Crisis Window**			
Dependent Variable: log(B_A Spread)				*Dependent Variable: log(B_A Spread)*			
Variable	Coefficient	t-statistic	Prob	Variable	Coefficient	t-statistic	Prob
Constant	-8.00	-71.51	0.00000	Constant	-7.91	-62.14	0.00000
Dummy	-0.32	-2.03	0.04240	Dummy	-0.75	-4.47	0.00000
Ratings	0.26	20.53	0.00000	Ratings	0.21	13.58	0.00000
Dummy*Ratings	0.01	0.80	0.42500	Dummy*Ratings	0.07	3.89	0.00001
R^2	0.63			R^2	0.54		

Table 13. Ecuador. Regression results of semi-log test of bid-ask spread on ratings, during three month windows centered around the crisis date, and three month outside window(months –6 to –3 and +3 to +6). Dummy= 0 before the crisis and 1 after the crisis.

$$\log(B\_A\_Spread) = \alpha + \beta * Dummy + \gamma * Ratings + \theta * Dummy * Ratings$$

Three Month Around the Crisis Window				**Three Month Outside Crisis Window**			
Dependent Variable: log(B_A Spread)				*Dependent Variable: log(B_A Spread)*			
Variable	Coefficient	t-statistic	Prob	Variable	Coefficient	t-statistic	Prob
Constant	-8.74	-91.83	0.00000	Constant	-8.67	-90.98	0.00000
Dummy	-0.38	-2.18	0.02900	Dummy	-0.22	-0.98	0.32600
Ratings	0.27	26.62	0.00000	Ratings	0.28	25.93	0.00000
Dummy*Ratings	0.02	1.20	0.23030	Dummy*Ratings	-0.03	-1.17	0.24100
R^2	0.62			R^2	0.67		

The results shown with the Russian crisis hold in a similar way with the Brazilian crisis (Table 12), also the effect, still significant, seems to be delayed. The interaction variable

there is strongly significant as well and cumulates over 6 months before and after as well to strong levels. The Ecuadorian crisis (Table 13) did not provide similar effects to credit risk pricing to the rest of the world, despite its significance as the first Brady bond default[18]. To affect overall credit markets, crises appear to need a critical size.

VII. CONCLUSION

Our study of the credit default swap market around major financial crises leads to several results. Markets' consideration of ratings around the world changes dramatically after major financial crises. It looks as if market participants were using some other factors before financial crises but suddenly congregate around ratings information for pricing default straight after crises. It appears as much as a behavioral change as an informational change. Interestingly, the pricing relationship of ratings remains the same (there is thus no new information on ratings content in that sense) but they suddenly become the most important source of information. After crises, there is also a significant flight to quality that is accompanied by a strong relative rise of demand for credit protection. This excess demand does not translate into more transactions. But it does translate into significantly larger bid-ask spreads, even controlling for rating quality. Financial crises thus seem to lead to more information uncertainty than information itself. Crises do not appear as a resolution of information uncertainty for the rest of the world but rather as creating information uncertainty. This could by itself feed back in the sudden need to rely predominantly on what could be a weak but rather stable source of information, possibly the information of last resort when crises shake pricing systems: ratings.

[18] See also Appendix I for summary statistics of the underlying data.

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Appendix I . Bid-Ask spread summary for Russia, Brazilian and Ecuadorian crisis

Bid-Ask Spread Summary: Russia Crisis Summary

	Before Crisis Window (3-months)			After Crisis Window (3-months)		
	Frequency	***Mean***	***S.D.***	***Frequency***	***Mean***	***S.D.***
AAA	22	0.00037	0.0002848	42	0.000511	0.0002401
AA+	2	0.00035	0.0000707	3	0.000467	0.0001528
AA	3	0.0006	0.0006083	20	0.00067	0.000323
A	27	0.0035296	0.0028914	7	0.004614	0.003097
A-	1	0.0015	n/a	1	0.005	n/a
BBB+	55	0.0003209	0.0017656	39	0.00441	0.0020419
BBB	10	0.00127	0.0005122	1	0.005	n/a
BBB-	72	0.0016792	0.0020993	63	0.002432	0.0040318
BB+	15	0.0058567	0.0060091	18	0.0065	0.0030641
BB	0	n/a	n/a	17	0.020735	0.013030397
BB-	2	0.00575	0.003182	3	0.0275	0.0086603
B+	10	0.0076	0.0040263	2	0.035	0.0070711
B	1	0.0165	n.a	1	0.02	n/a
CCC+	2	0.04	0.0141421	0	n/a	n/a
Total	**222**	**0.00312**	**0.004644**	**220**	**0.00495**	**0.008113**

Bid-Ask Spread Summary: Brazilian Crisis Summary

	Before Crisis Window (3-months)			After Crisis Window (3-months)		
	Frequency	***Mean***	***S.D.***	***Frequency***	***Mean***	***S.D.***
AAA	55	0.000612	0.000275	66	0.000465	0.00015
AA+	2	0.000775	3.54E-05	0	n/a	n/a
AA	20	0.000785	0.000372	5	0.00024	5.48E-05
A	1	0.004	n/a	1	0.003	n/a
A-	5	0.0031	0.001517	8	0.001563	0.000478
BBB+	41	0.004041	0.001827	51	0.00299	0.001837
BBB	20	0.001355	0.000843	51	0.000858	0.000472
BBB-	47	0.003932	0.005605	22	0.009955	0.00636
BB+	16	0.007763	0.006009	12	0.01	0.005893
BB	38	0.015355	0.008239	33	0.01347	0.010226
BB-	12	0.021667	0.007098	0	n/a	n/a
B+	1	0.03	n/a	10	0.034	0.016591
B	2	0.0225	0.003536	11	0.024091	0.010913
CCC+	2	0.175	0.035355	0	n/a	n/a
Total	**262**	**0.00702**	**0.01682**	**270**	**0.00604**	**0.00991**

Bid-Ask Spread Summary: Ecuador Crisis Summary

	Before Crisis Window (3-months)			After Crisis Window (3-months)		
	Frequency	***Mean***	***S.D.***	***Frequency***	***Mean***	***S.D.***
AAA	47	0.000324	0.0000949	16	0.000241	0.00008
AA+	2	0.0003	0.0000707	3	0.0003	0.00005
AA	4	0.0002875	0.0001031	2	0.00045	7.07E-05
A+	1	0.001	n/a	1	0.001	n/a
A	0	n/a	n/a	1	0.002	n/a
A-	12	0.001357	0.0004363	13	0.0006	0.000327
BBB+	8	0.0015	0.000378	0	0	n/a
BBB	176	0.0013256	0.0007818	91	0.001421	0.001109
BBB-	89	0.0039427	0.0047528	46	0.00245	0.00193
BB+	40	0.0053375	0.00226848	26	0.004865	0.002504
BB	30	0.0071667	0.0021023	13	0.006192	0.002026
BB-	0	n/a	n/a	0	n/a	n/a
B+	18	0.0078611	0.0021338	8	0.008188	0.003683
B	10	0.001365	0.0085149	2	0.01125	0.005303
CCC+	0	n/a	n/a	3	0.02633	0.014613
Total	**439**	**0.003052**	**0.0038428**	**227**	**0.00293**	**0.00444**

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Founded as an academy in 1537, the University of Lausanne (UNIL) is a modern institution of higher education and advanced research. Together with the neighboring Federal Polytechnic Institute of Lausanne, it comprises vast facilities and extends its influence beyond the city and the canton into regional, national, and international spheres.

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