The reaction of emerging market credit default swap spreads to sovereign credit rating changes ♦

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Abstract

This paper examines the effect of sovereign credit rating change announcements on the CDS spreads of the event countries, and their spillover effects on other emerging economies' CDS premiums. We find that positive events have a greater impact on CDS markets in the two-day period surrounding the event, and are more likely to spill over to other emerging countries. Alternatively, CDS markets anticipate negative events, and previous changes in CDS premiums can be used to estimate the probability of a negative credit event. The transmission mechanisms for positive events are the common creditor and competition in trade markets.

JEL classification: F30; G11; G14; G15
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1. Introduction

The credit derivatives market has attracted significant attention and capital in the last decade, expanding from $180 billion in outstanding notional value in 1996 to approximately $33 trillion by the end of 2008.[1] Credit default swaps (CDS's) are the simplest and the most widely traded credit derivatives, capturing a substantial segment of the market.[2] A report issued by the British Bankers' Association indicates a recent increase in the fraction of the CDS contracts written on high-yield debt instruments, a fact that may be attributed to the expansion of emerging debt markets.[3] Emerging sovereigns are among the largest high-yield borrowers in the world. What distinguishes them from other high-yield obligors, however, is that countries in financial distress do not liquidate their assets or enter bankruptcy proceedings, but go through debt restructuring mechanisms in which defaulted bonds are exchanged for new longer maturity, lower yield debt instruments. Given the nature of sovereign default risk, it is important to determine how sovereign CDS markets react to credit rating announcements.

Using a daily data set consisting of dollar denominated CDS's written on high-yield sovereign reference entities, this paper investigates the reaction of CDS spreads to credit rating changes and the cross-border spillover effects of these events. In particular, we seek to address the following questions:

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[1] British Bankers' Association's *Credit Derivatives Report* 2006 and International Swaps and Derivatives Association's 2007 *Market Survey*.

[2] A CDS is an insurance contract that provides protection against the risk of default by a corporation or a sovereign entity, referred to as the reference entity. The regular payment made by the CDS buyer to the CDS seller is expressed as a percentage (usually basis points) of the contract's notional value, and is known as the CDS premium (or the CDS spread).

[3] British Bankers' Association's *Credit Derivatives Report* 2006.

1. Do credit rating announcements contain new information? Is the information content of positive and negative rating changes symmetric?
2. Can changes in CDS spreads be used to estimate the probability of future rating events? Are these changes equally useful in predicting positive and negative credit rating announcements?
3. If credit rating events contain new information, is there a spillover effect on the CDS spreads of other sovereign entities? Are the reactions of other countries' CDS spreads symmetric in response to positive and negative announcements? Do prior credit rating announcements contribute to the spillover effect?
4. Can economic fundamentals explain the size and the direction of the potential spillovers?

In an efficient market, CDS spreads should not change in reaction to credit rating announcements. Assuming that rating agencies rely on publicly available information to form their opinions, CDS spreads must already reflect this information. Therefore, our first hypothesis is:

H1: CDS markets are efficient and CDS spreads are not affected by rating announcements.

If CDS markets are efficient and rating agencies rationally rely on available information, we expect CDS spreads to narrow (widen) several days prior to a positive (negative) rating announcement. That is, having access to the same public information used by rating agencies, investors can make decisions that would lead to adjustments in CDS spreads prior to a rating announcement. Hence, our second hypothesis is:

H2: Credit ratings events are anticipated by CDS markets.

Several studies have demonstrated that a significant portion of sovereign CDS spreads is explained by common factors such as investors' risk appetite and global economic fundamentals (Remolona et al., 2008; Longstaff et al., 2008). In this case, any rating announcement containing new information should have spillover effects on the CDS spreads of other sovereigns, leading to our third hypothesis:

H3: Rating announcements containing new information have spillover effects on the CDS markets of other sovereigns.

Additionally, if rating events occur in short successions, the spillover effect of the current event may be affected by the information content of previous rating announcements. Therefore, we hypothesize that:

H4: The impact of rating announcements on CDS markets is diminished by prior rating announcements.

If a significant portion of sovereign CDS spreads can be explained by common factors (McGuire and Schrijvers, 2003; Remolona et al. 2008; Ciarlone et al., 2009), spillover effects could occur through the impact of a rating announcement on these factors. Alternatively, the spillover effects could arise if the announcement reveals new information about economic fundamentals. To answer our final question, we explore whether potential spillovers can be explained in terms of specific economic channels such as a common lending center or competition among sovereigns in the area of capital or trade flows.

Our findings generally reject the first hypothesis; rating announcements appear to reveal new information that affects CDS spreads. More specifically, premiums display a stronger reaction to positive announcements, but respond weakly to negative events. The latter indicates that the information contained in credit downgrades is already incorporated in CDS spreads by

the time the rating announcement is released. Thus, our results support *H2*, suggesting that investors may be able to use changes in CDS spreads to estimate the probability of a rating event. We find that changes in CDS premiums are particularly useful in estimating the probability of negative events. We also find that while positive events display some spillover effects, negative credit rating announcements have no impact on CDS spreads of other emerging economies. The spillover effect of positive events, however, is only marginally significant and its impact is considerably reduced by prior rating events; therefore, we cannot reject *H4.*

The transmission channels of these spillover effects are the common lending center and competition in trade markets. In the context of the lending center, an increase in the credit quality of a sovereign relieves the capital requirements of its lending center making more capital available to other countries. Increased access to capital reduces the financial constraints of these governments, ultimately leading to lower CDS premiums on their debt. Alternatively, as a country's credit quality improves, it becomes more attractive to the world markets affecting capital flows to other countries and (eventually) increasing their levels of CDS premiums.

The remaining part of this paper is organized as follows. Section 2 reviews the related literature. A brief discussion regarding sovereign credit ratings and debt defaults follows in Section 3. Section 4 describes the data and provides a preliminary analysis. Section 5 discusses the methodology and summarizes the empirical results. Section 6 concludes.

2. Related literature

A considerable number of studies have analyzed the impact of credit rating announcements on bond markets (Hite and Warga, 1997; Steiner and Heinke, 2001; Gande and Parsley, 2005), stock markets (Dichev and Pietroski, 2001; Vassalou and Xing, 2003) or both

(Hand et al., 1992). They all find evidence of market reaction to credit downgrades, but no (or weak) response to upgrades. Furthermore, as Hand et al. (1992) report, the average excess bond returns associated with downgrades are stronger for below investment grade bonds than for investment grade bonds.

More recently, sparked by the rapid growth of credit derivatives, attention has shifted to analyzing the effect of credit rating events on credit derivatives markets. Norden and Weber (2004) find that both the stock and CDS markets anticipate negative rating events, but neither exhibits any significant response to positive events. Hull et al. (2004) investigate whether CDS spreads widen before or after a Moody's rating event, and examine the contribution of CDS spread changes to estimating the probability of a change in credit ratings. Their study considers investment grade instruments only, arguing that credit derivatives are rarely written on below investment grade categories. The British Bankers' Association (2006), however, states that the share of below investment grade entities in CDS markets has increased significantly in recent years. Therefore, it is worthwhile to examine whether similar results hold for the high-yield segment of the market.

Norden (2008) finds that firms with high media coverage exert greater abnormal CDS spread changes and higher long-term run-ups when downgrades or revisions for downgrades are announced, but the CDS market's short-term surprise is stronger for firms with low media coverage. Additionally, the anticipation of negative events increases with the amount of private information (proxied by the number of banking relationships) spilled over to the CDS markets. Using stock market and CDS data, Jorion and Zhang (2009) examine the impact of a borrower's bankruptcy on its creditors and report that creditors experience significant negative abnormal stock returns and increases in CDS spreads in the 3-day and 11-day event windows. Acharya and

Johnson (2007) investigate the existence of insider trading in CDS markets**.** They find that significant information (exclusively bad news) flows from the CDS market to the stock market for entities that have high CDS premium levels or experience a decline in credit quality. The degree of information flow increases with the number of banking relationships, but no evidence that the degree of insider activity adversely affects prices or market liquidity is found.[4] Forte and Pena (2009) also study the dynamic relationship between CDS and stock markets, and report that stock markets play a leading role in price discovery.[5]

The other strand of research our study relates to focuses on the transmission mechanisms of a financial crisis from one country to another. Eichengreen et al. (1997) and Glick and Rose (1999) find that currency crises appear to spread more so through international trade than through financial linkages or macroeconomic similarities. Similarly, Ito and Hashimoto (2002) argue that bilateral trade linkages are an important transmission mechanism of exchange rate shocks. In contrast, competition in credit markets and common creditors have been identified as the main transmission channels in the case of sovereign defaults (Van Rijckeghem and Weder, 1999; Kaminsky and Reinhart, 2000; Hernandez and Valdes, 2001). More recently, Gande and Parsley (2005) have examined the transmission mechanisms of sovereign credit rating changes in credit markets and find trade and financial linkages to be the most relevant channels. To our knowledge, we are the first to document the spillover effects in CDS markets and their channels of transmission.

[4] In fact, Norden and Wagner (2008) find that CDS markets have become increasingly important for banks, as CDS prices contain information relevant for bank lending.

[5] Alexander and Kaeck (2008) go one step further and show that the relationship between CDS and stock markets is time-sensitive; CDS spreads are influenced by stock volatility during periods of CDS market turbulence and are more responsive to stock returns in ordinary market circumstances.

3. Sovereign credit ratings and debt defaults

The top three rating agencies in the U.S. are Standard and Poor's (S&P), Moody's, and Fitch Ratings. They all have developed their own systems of ratings to grade sovereign and corporate borrowers, which, although different in form, are rather similar in content. All rating agencies' issuer credit ratings express a relative ranking of an issuer's creditworthiness reflecting the issuer's overall ability and willingness to meet its senior, unsecured obligations. It is based on current information voluntarily supplied by obligors or obtained from other reliable sources. When rating agencies perceive that an issuer's financial standing may change, the issuer is placed on either watch-positive or watch-negative, both of which are short-term in nature. Alternatively, Rating Outlooks reflect trends that have not yet reached a level that would trigger a rating action, but could occur if such trends continue. They indicate heightened probability of a rating change over the next one to two years.[6]

From a legal perspective, a sovereign default event occurs when a scheduled debt service is not paid beyond a grace period specified in the debt contract. Unlike a corporation, on the rare occasions when a government defaults on its debt, it does not file for bankruptcy. As recent practices have shown, most default episodes are followed by a debt exchange or debt restructuring between creditors and the defaulting borrower. Under the new settlement, payments promised by the government typically involve a combination of lower principal, lower interest

[6] In the aftermath of the 2008 subprime mortgage crisis, credit rating agencies have been criticized because of the perceived inflated ratings assigned to mortgage backed securities. Stolper (2009) shows that although rating agencies have the incentive to assign inflated ratings to debt securities, an existing approval scheme induces them to allocate correct ratings.

payments, and longer maturities. In this process, sovereigns effectively trade off the reduced cost of making debt repayments against the increased costs of reputation effect, asset seizure, increased regulatory monitoring, reduced access to external finance, and international trade disruptions. A typical emerging market CDS contract allows for restructuring as a credit event (Packer and Suthiphongchai, 2003; Packer and Zhu, 2005).

When entering into a CDS contract, the counterparties choose the settlement method (e.g., cash settlement or physical settlement). The parties also specify which credit event (e.g., default, repudiation, or moratorium) will trigger the settlement. Under the physical settlement, the parties must agree on the nature and the characteristics of the debt obligation that will be delivered by the protection buyer within a specific period from the credit event notice. In the case of cash settlement, the settlement amount is typically based on the market price of the defaulted reference obligation. More precisely, the protection seller covers the loss of the value of the reference obligation caused by the credit event by paying the protection buyer the notional amount of the trade multiplied by the loss of value of the defaulted obligation.[7]

4. Data and preliminary analyses

4.1. Credit default swap spreads

This study's primary data set consists of daily observations of CDS spreads obtained from Markit Group Limited, a London based distributor of credit pricing data. Markit provides daily market CDS spreads on over 3,000 individual entities traded in different currencies, maturities, and documentation clause levels. It receives contributed CDS data from official records of market makers. Collected daily from more than 70 industry-leading firms, the data set

[7] For further details, see ISDA Documentation (www.isda.org).

undergoes a rigorous cleaning process. Once stale, flat curves, outliers, and inconsistent data are discarded, Markit creates daily composite quotes for each CDS contract.

The sovereign CDS contracts in the Markit database are U.S. dollar and Euro denominated and come with different maturities from 6 months to 30 years. As the majority of contracts are denominated in U.S. dollars and belong to the same tier level, for consistency we eliminate all Euro denominated and all subordinated classes of contracts and retain only the U.S. dollar denominated, senior tier contracts. Additionally, we focus on five-year premiums as this is the largest and the most liquid segment of the emerging economies CDS market. Our interest in emerging market sovereigns stems from the non-investment grade status they are generally assigned by rating agencies making them more prone to default, and the special nature of their default risk making them hard to default in classic terms.

The final sample has 22 reference entities and 43,436 daily observations from January 2, 2001 to April 22, 2009. The 22 emerging markets are: Argentina, Brazil, Chile, China, Colombia, Ecuador, Egypt, El Salvador, Indonesia, Israel, Lebanon, Malaysia, Mexico, Panama, Peru, Philippines, South Africa, South Korea, Thailand, Turkey, Venezuela, and Vietnam.

Summary statistics on the CDS data for each country are provided in Table 1. From January 2, 2001 to April 22, 2009, CDS premiums varied significantly by country ranging from 46.77 bps for China to 1,888.69 bps for Argentina. The general trend was an increase in the CDS premiums across all countries, illustrated in column 6, where the average CDS spread daily percentage change for each country is positive. The trend was dominated by sharp rises in CDS premiums at the beginning and the end of the sample period, reflecting the Argentine crisis and its aftermath and the 2008 global credit crisis, respectively. Superior credit quality and low default risk in emerging markets, however, were also present from 2005 through the end of 2007.

For illustrative purposes, Figure 1 displays the time-series behavior of mean CDS spreads of an equally-weighted portfolio formed with all countries in our sample.

Insert Table 1 and Figure 1 about here.

4.2. Credit rating events

We collect credit rating events from S&P's *Sovereign Rating and Country Transfer and Convertibility Assessment Histories*. Previous studies find that S&P rating changes occur more frequently, are less anticipated by markets, and precede those of other rating agencies (Gande and Parsley, 2005; Reisen and von Maltzan, 1999).

In this study, a credit rating event is defined as either a change in a country's credit rating or a change in its review for a rating change. Positive events are upgrades of S&P's letter credit ratings or upward revisions in the sovereign's credit outlook, whereas negative events are downgrades of letter credit ratings or downward revisions in the sovereign's credit outlook. As S&P frequently places a country on credit watch-positive (watch-negative) several months prior to an upgrade (downgrade), incorporating changes in a country outlook in the analysis adds information regarding a sovereign's credit health.

From January 1, 2001 to April 22, 2009, S&P reported 161 credit rating changes for the 22 emerging markets in our sample. The deteriorating credit quality of the majority of countries in our sample in the early 2000s is evidenced by the relatively high number of credit downgrades and credit outlook downward revisions announced by S&P. Thirty-four of the total 67 negative events were reported in the first two years only. Argentina alone was downgraded eight times before its government defaulted on November 6, 2001. The credit quality of emerging markets has also declined since the onset of the 2008 economic crisis, resulting in 15 credit downgrades

including the default of Ecuador in December 2008. For all other years, positive events outnumbered negative events (see Table 2, Panel A). No credit rating announcements were made during the first four months of 2009 (until April 22nd).

Insert Table 2 about here.

In order to quantify credit rating events, we assign numerical values to S&P's letter credit ratings and credit outlooks. For letter credit ratings, we create a ratings scale from -1 to 17 with AAA rating taking the highest value and SD ("Selective Default") the lowest. For further details, see the Appendix. Similarly, credit outlooks take on values from -0.5 for outlook "Negative" to 0.5 for outlook "Positive." Typically, S&P assigns the outlook NM ("Not Meaningful") to a sovereign that is in default or selective default. Because it does not convey any information, we assign it a zero value. Finally, following Gande and Parsley (2005), for each reference entity, we create a comprehensive credit rating (CCR) by adding the numerical values assigned to the letter credit rating and credit outlook of that entity. For example, on March 4, 2002, Malaysia's outstanding U.S. dollar denominated government debt was rated BBB/Positive. Thus, from March 4, 2002 until Malaysia's next credit rating event on August 20, 2002, the comprehensive credit rating of Malaysia was 9.5.

Movement in a country's CCR signifies a credit rating event. A change greater than or equal to 1 (less than or equal to -1) indicates an upgrade (downgrade) of the country's letter credit rating, while a change between 0 and 1 or between -1 and 0 usually indicates, respectively, an upward or downward revision in the sovereign's credit outlook. The succession of credit rating events of sovereigns in our sample is plotted in Figure 2. Their distribution per day is set forth in Table 2, Panel B. From January 2001 until December 2008, there were 146 single event days (with 83 positive and 63 negative rating announcements), two days with one negative and

one positive rating event, and five days with two or three simultaneous rating changes, either all positive or all negative. Most of these rating events occurred within less than 30 days of each other. More importantly, negative rating changes clustered at the beginning and the end of the sample period in 2001, 2002, and 2008, while positive events were predominant from 2003 to 2007 (Table 2, Panel A).

Insert Figure 2 about here.

5. Empirical results

This study applies standard event study methodology to examine how CDS markets respond to S&P's credit rating and credit outlook announcements during the years 2001-2008. We measure the CDS market response to any change in the credit rating by the two-day CDS spread change over the period [-1, 1], where the rating event is considered day zero. To control our response measure for changes in global market conditions, we use an adjusted CDS spread change. The adjusted CDS spread is defined as the difference between the sovereign's CDS spread and the spread of an equally-weighted portfolio created with all reference entities in our sample. Its change is measured over the same two-day period, [-1,1]. The two-day measurement window is preferred to the standard 30-day period to avoid the event window contamination problem. It is also used to correct for non-synchronous trading that may arise from time zone differences between the U.S., where S&P makes the rating announcement, and the location of the CDS trade.

Defaults are severe credit events that are usually anticipated by investors. Yet, a few of them still manage to take the markets by surprise. Argentina and Venezuela defaulted on their financial obligations on November 6, 2001 and January 18, 2005, respectively. The CDS market

reaction to each default event is illustrated in Figures 3 and 4. Starting a little shy of 1,000 bps, Argentina's CDS spread moved up throughout 2001. By the time it defaulted in November, its CDS spread had already exceeded 5,600 bps, and continued to increase thereafter. Alternatively, Venezuela's credit quality was slowly improving and its CDS spread declining when S&P downgraded its credit rating to "Selective Default" for a missed $35 million payment on oil-indexed obligations of Petróleos de Venezuela. Its CDS spread increased during and after the technical default, but Figure 4 suggests that Venezuela's default was not expected by the CDS markets.

Insert Figures 3 & 4 about here.

Therefore, the first question we posit in this study is how CDS markets typically react to credit rating events. Are the latter anticipated and absorbed by the markets before they occur or they are largely unexpected, in which case CDS spreads change dramatically only around and after the rating announcement? We answer these questions in the following section.

5.1. Rating announcements in event countries

In this section, we test the first hypothesis and examine whether event-country CDS spreads respond to S&P credit rating announcements. The event country is the country related to the S&P rating announcement. The variables of interest are the two-day CDS spread change and adjusted CDS spread change over the period [-1, 1]. Basic statistics of the two-day CDS spread changes and adjusted CDS spread changes are summarized in Table 3a. Given a rating event at time t, we define the two-day (adjusted) CDS spread change over period [t-1, t+1] as the difference between the (adjusted) CDS spread at time t+1 and the (adjusted) CDS spread at time

t-1. The (adjusted) CDS spread percent change is the (adjusted) CDS spread change over period [*t*-1, *t*+1] to the (adjusted) CDS spread at time *t*-1.

Insert Tables 3a and 3b about here.

During the two-day period surrounding the 87 positive rating events with corresponding CDS data available in the Markit data set, emerging market CDS spreads declined, on average, by 6 bps in the first day and 5 bps in the second (see Table 3b) reducing the average CDS spread by 11 bps in two days (see Table 3a, Panel A). This is equivalent to a 2.23% drop in CDS premiums (see Table 3a, Panel B). Similarly, following a negative event, the average CDS premium increased by a total of 67 bps or 5.77% from day -1 to day 1. Comparable numbers are obtained for adjusted CDS spread changes (see Table 3a, Panels C and D). Given the non-normal distribution of the two-day (adjusted) CDS spread changes and percent changes and the small sample of event countries, the results of a t-test are biased; using a bootstrap approach, none of the means are significantly different from zero.

As means are affected by outliers, another way to test whether rating events transmit new information to CDS markets is to look at the proportion of negative and positive CDS spread changes over the period [-1, 1]. These results are set forth in Table 4, where the equality of proportions is tested with a chi-square test. Generally, positive rating events appear to contain new information as CDS markets responded immediately to most of them. More than 78% of the 87 positive rating announcements resulted in a decline in the event country's CDS spreads from day -1 to day 1. These results continue to hold when CDS spreads are replaced by adjusted spreads, or when rating events are broken down into credit rating or credit outlook changes. In contrast, CDS markets react weakly at best to negative credit rating events leading us to conclude that the latter transmit no or little new information. Overall, our findings reject *H1*.

Insert Table 4 about here.

Our results appear to contradict previous studies, predominantly performed on corporate CDS markets (Norden and Weber, 2004; Hull el al., 2004; Norden, 2008), which generally conclude that only negative credit rating announcements transmit useful information as evidenced by the markets' strong reaction to these events. When responses of investment grade and below investment grade entities are analyzed separately, however, our results are consistent with the existing work. In other words, while CDS premiums of investment grade entities display strong reactions to negative rating events, CDS spreads of below investment grade entities tend to respond to positive rating events (Hull el al., 2004; Micu et al., 2006).

One reason for this differential behavior may be that restricted financial institutions (i.e., mutual funds, pension funds, etc.) need to divest from downgraded investment grade issues, while they can increase their investments in upgraded below investment grade instruments. Note that this differential effect would take place even when the credit rating announcement contains no new information. Conversely, credit downgrades of below investment grade entities would solicit market reactions only if they contained new information. Since the vast majority of the countries in our sample is speculative-grade and remains speculative-grade within the sample period, we attribute the CDS market's response or lack of response to credit events to the latter's information content rather than the buying/selling pressure by restricted investors.

Given the above results, the question that naturally arises is whether CDS markets had already absorbed any available negative information by the time the rating announcements were made. To answer this question and test our second hypothesis, we look at the proportion of

negative and positive CDS spread changes within a few months prior to the rating event. We report the results for periods [-30, -1], [-60, -31], and [-90, -61] in Table 4.[8,9]

As expected, a significant fraction of credit rating upgrades were preceded by negative CDS premium changes at least one month prior to the rating event, leading us to conclude that favorable credit rating announcements were anticipated. As Gande and Parsley (2005) point out, positive rating events may be more anticipated than negative changes due to greater incentives by a foreign government to leak good news after a favorable discussion with a rating agency. Our analysis indicates, however, that increases in CDS spreads prior to negative credit rating events were even stronger. Approximately 83% of downgrades were preceded by positive adjusted CDS premium changes in the month before the credit rating event. In contrast, only 70% of upgrades were preceded by negative adjusted CDS premium changes in the month prior to a credit rating event. Overall, our results support *H2*.

In summary, consistent with our results related to *H1,* we find that the information content of negative credit events is anticipated and already reflected in CDS spreads by the time the credit rating change is announced. Alternatively, CDS spreads do not fully anticipate upcoming positive credit rating events, which seem to contain new information.

5.2. CDS spreads and the probability of rating events

[8] To avoid contamination, S&P rating events that were preceded by other events in the same country in the previous 30 days (for period [-30,-1]), 60 days (for period [-60,-31]), or 90 days (for period [-90,-61]) were eliminated.

[9] For robustness, we also use cumulative (adjusted) CDS spread daily percentage changes for each of the three months prior to the rating event instead of monthly (adjusted) CDS spread differences. The results (not reported) are largely consistent with those obtained in Table 4.

So far our findings suggest that one month prior a credit rating event the majority of CDS spreads move in the right direction. But are CDS premium changes significant enough to predict a rating announcement? To address this question, we use a logistic model.

For each reference entity, we identify the months in which a rating event occurs and associate the event with the reference entity's CDS spread change in the previous month. The spread change is defined as the difference between the last and the first CDS spreads observed in a month. Months that have fewer than two spread observations for the reference entity are excluded. If events occur in two consecutive months, the first month spreads may not be useful in estimating the probability of a rating event in the second month as they might have been contaminated by the first month event. For this reason, for each reference entity, we eliminate the event month that immediately follows another event month. Finally, the months with no rating event are the control group in the logistic model.

As before, the analysis is carried out separately for negative and positive events. Table 5 summarizes our results. In Model 1, the covariate is the CDS spread change in the month preceding an event. In Model 2, the covariate is the adjusted CDS spread change. For each model, β_0 is the constant and β_1 is the coefficient of the covariate. The goodness-of-fit is measured with the pseudo-R^2 of Cragg-Uhler

$$pseudoR^2 = 1 - \left(\frac{L_\omega}{L_\Omega} \right)^{2/n} \qquad (1)$$

where L_Ω is the maximum likelihood function for the unrestricted (full) model, L_ω is the maximum likelihood function for the restricted model (when the covariate's β is set to zero), and n is the sample size.

Insert Table 5 about here.

Consistent with Hull et al. (2004), we find that although all covariate coefficients have the right sign, CDS spreads are better at estimating the probability of negative rating events than the probability of positive rating events. This result confirms our previous finding of a greater anticipation effect for downgrades than upgrades'. With one exception, the covariates are significant at the 5% level or better in predicting a downgrade or a downward revision of a credit rating, but insignificant in estimating the probability of an upgrade or an upward revision of a credit rating.[10]

5.3. Spillover effects

In this section, we extend the previous analysis and investigate the spillover effects of a rating event that occurs in one emerging country on CDS spreads of other emerging economies. In addition to the spillover effect, our points of interest can be summarized in a few questions. Is the impact of a credit rating event affected by the credit quality of the event country? Are spillover effects more pronounced in low credit quality markets than in credit healthy economies? Are the effects of a credit rating event diminished by prior announcements?

To answer these questions, we regress the CDS spread change of a non-event country on the change in the comprehensive credit rating (CCR) of the event country. Adjusting the CDS spread for general market conditions by using an equally-weighted CDS index created with reference entities in the sample understates spillover effects, as the latter also affect the CDS

[10] For robustness, all tests that measure the response of CDS markets to credit rating changes and the effectiveness of CDS premiums in predicting rating announcements are repeated based on the credit rating events compiled from all three rating agencies (S&P's, Moody's, and Fitch Ratings). The results (not reported) are largely similar to those reported in Tables 4 and 5.

spreads of the index (Jorion and Zhang, 2007). To avoid this bias, the dependent variable in all regression models in this section is the CDS spread change instead of the adjusted CDS spread change.

As reported in Table 1, the emerging market CDS spreads in our sample range widely from 46.77 bps for China to 1,888.69 bps for Argentina. Thus, a 10 basis point move in CDS premiums will be negligible for Argentina, but it is a roughly 20% change in China's CDS spread. To account for this asymmetric effect caused by the same basis point change in CDS spreads, we use the two-day CDS spread percentage change as the dependent variable in the regression model instead of the two-day CDS spread change. As before, the two-day window is preferred to a longer period in order to mitigate the event widow contamination problem.

The first regression model we estimate is:

$$\Delta CDSspread_{NE,t} = \alpha_0 + \alpha_{1NE,t} Event_{E,t} + \sum_k \alpha_k X_{kNE,t} + \varepsilon_{NE,t} \quad (2)$$

where

$$\Delta CDSspread_{NE,t} = \left(CDSspread_{NE,t+1} - CDSspread_{NE,t-1} \right) / CDSspread_{NE,t-1} \quad (3)$$

Time t is the event time and X_k are country and year dummies. For estimation, we pool the data for all non-event countries, *NE*, at each event time t. A non-event country is a country with no credit rating announcement at time t. An event country is a country that experiences a credit rating change at time t. The variable $Event_{E,t}$ is the aggregate change in comprehensive credit ratings of all event countries E at time t. To account for differences in annual trends displayed by CDS spreads from 2001 to 2008, we also include year dummies in the model. Finally, we expect

spillover effects to depend on the credit qualities of the event and non-event countries. Thus, we introduce two interaction variables in the regression model, the comprehensive credit ratings of event and non-event countries, CCR_E and CCR_{NE}, and assume an approximately linear relationship between the coefficient of *Event* and these two variables.

$$\alpha_{1NE,t} = \beta_1 + \gamma_1 CCR_{NE,t} + \delta_1 CCR_{E,t-1} + \eta_{NE,t} \tag{4}$$

With this amendment, the regression model becomes:

$$\begin{aligned} \Delta CDSspread_{NE,t} = {} & \alpha_0 + \beta_1 Event_{E,t} + \gamma_1 Event_{E,t} * CCR_{NE,t} + \delta_1 Event_{E,t} * CCR_{E,t-1} \\ & + \sum_k \alpha_k X_{kNE,t} + \varepsilon'_{NE,t} \end{aligned} \tag{5}$$

An important characteristic of emerging markets from January 2001 to December 2008 is the temporal association of their credit rating events. In 2001 and most of 2002 and 2008, negative events were followed shortly by other negative events, while positive events occurred in isolation. During the period 2003-2007, positive events were predominant and clustered, while negative events were less frequent. Failing to account for this credit ratings pattern may bias our estimations of reaction of CDS spreads to current rating changes, as the former may also be affected by previous rating changes. To correct for this temporal clustering of events, we amend the original model once again to include the previous event.

$$\begin{aligned} \Delta CDSspread_{NE,t} = {} & \alpha_0 + \beta_1 Event_{E,t} + \gamma_1 Event_{E,t} * CCR_{NE,t} + \delta_1 Event_{E,t} * CCR_{E,t-1} \\ & + \alpha_2 PriorEvent_{E,t} + \sum_k \alpha_k X_{kNE,t} + \varepsilon''_{NE,t} \end{aligned} \tag{6}$$

PriorEvent is defined as the cumulative comprehensive credit rating changes of event countries in the month before the current event. For robustness, we also consider the two- and three-week windows. The results (not reported) are largely consistent with those obtained with the one-month window. We estimate the models in Equations (5) and (6) separately for positive and negative events. Overall, there are 1,666 non-missing observations for positive events and 851 for negative events. Our results are reported in Table 6.

Insert Table 6 about here.

Since we have already found that positive rating announcements appear to contain new information for the event country, if any spillover effect exists, it is most likely to be observed for the positive rating announcements. The results reported in Table 6 tend to support this observation and our third hypothesis. A notch upgrade in the credit rating of the event country reduces the average CDS spread of a non-event country by approximately 1.18%. These findings differ from those of Gande and Parsley (2005) who report that positive rating changes abroad have no significant spillover effects on credit spreads, while negative rating events are associated with a significant increase in credit spreads. We attribute the discrepancy between our results and Gande and Parsley's (2005) to institutional and liquidity differences between CDS and bond markets and to the sample period.

International and local investors have long enjoyed participation in sovereign debt markets. According to Sapriza et al. (2009), however, in times of adverse credit conditions, the observed information flow in sovereign bond markets is a reflection of the information advantages of local debt holders. In contrast, limited participation by local investors in sovereign CDS markets makes them less informative than the corresponding bond markets in regard to sovereign credit risk (see also Deutsche Bank Research, 2004; Ranciere, 2002). This information

asymmetry may explain the lack of response by the CDS markets, but the strong reaction of the corresponding bond markets to negative credit rating events. Moreover, the relatively high liquidity of and ease with which credit can be shorted in the sovereign CDS markets as compared to the lower liquidity of and greater difficulty and cost of shorting emerging markets debt (especially high yield) may also help explain the discrepancy between our findings and those of Gande and Parsley's.

Finally, the time period of our study has virtually no overlap with that used in Gande and Parsley (2005). Their study covers sovereign bond spreads during 1991-2000, while our study uses CDS premiums from 2001 to 2008. In fact, the development of the CDS market for sovereign debt since 1997 may have influenced the way bond prices react to new information. If CDS markets are more efficient than bond markets, we generally expect to see weaker spillover effects in CDS markets.

The way the credit quality of the event and non-event countries enhances the spillover effects is asymmetrical. As a result of a positive rating event, the non-event country with a higher credit rating will experience a significantly larger change in its CDS spread than a lower credit quality entity. Alternatively, conditional upon a negative rating event, the non-event country will experience a greater change in its CDS spread if the event comes from a low credit quality country.

Estimation results for Model 2 (reported in the second row of each panel in Table 6) confirm the importance of conditioning our tests on previous credit rating announcements (see also Gande and Parsley, 2005; Norden and Weber, 2004). After controlling for past events, the impact of current events on CDS spreads declines significantly. This finding is consistent with *H4*. The role of the coefficient of *PriorEvent* in Table 6 is to reduce the spillover effect of the

current rating event, given the other credit rating changes announced by S&P in the previous month.

5.4. Transmission channels for positive events

Do the spillover effects of positive rating events have any economic basis or do they result from regional proximity or other non-fundamental factors? To answer this question, we examine several transmission mechanisms that have proved to be effective in explaining spillover effects.

Van Rijckeghem and Weder (1999) and Kaminsky and Reinhart (2000) have identified the common creditor as an important transmission channel in the case of sovereign defaults. As they point out, when a bank faces a marked rise in non-performing loans of one country, it is forced to re-capitalize, lend less, and adjust to its lower level of equity. This may inevitably lead to a significant deterioration of the financial position of other countries that rely on the same lender. One can argue, however, that the opposite is also possible. That is, a positive credit rating event would enable the common lender to allocate more funding to its borrowers, thereby improving their financial condition. This increased access to capital reduces the likelihood of a government's default, its borrowing cost, and, ultimately, the CDS premium on its debt.

Of the 30 countries that quarterly report their on-balance sheet financial claims on the rest of the world to the Bank for International Settlements (BIS Quarterly Review - Consolidated Banking Statistics, Table 9B), the U.S. and Japan emerge as major lenders to the sovereigns in our sample. While the majority of our sample countries turn to U.S. banks for foreign capital, Asian countries borrow predominantly from Japanese banks. Given this finding, we create a common lender dummy variable that takes the value of one if the non-event country borrows

money from the same banking center as the event country, and zero otherwise. We hypothesize that a positive credit rating event coming from a country that uses the same lender lowers the CDS premium of the non-event country.

International trade is another transmission mechanism that has proven to be relevant in currency and credit crises (Eichengreen et al., 1997; Glick and Rose, 1999; Kaminsky and Reinhart, 2000), as well as in the transmission of credit rating changes into debt markets (Gande and Parsley, 2005). As Kaminsky and Reinhart (2000) point out, the most obvious type is bilateral trade between the event and the non-event countries. The second type involves competition in a common third market.

To measure the effectiveness of bilateral trade as a transmission channel of credit rating changes into CDS markets, we consider the trade flows (exports plus imports) between the event and the non-event countries as a percentage of the total exports and imports of the event country. Monthly bilateral trade series are obtained from the IMF's Direction of Trade Statistics. The two-day CDS spread surrounding the rating event is matched with the bilateral trade flows between the event and the non-event country in the month preceding the event.[11] We expect a high level of bilateral trade to benefit both countries; thus, any good news pertaining to one country will spill over to the other country.

To quantify competition in a third market, we compute first the correlation between the trade flows (exports plus imports) of the event and the non-event countries with the U.S., and then the correlation between the gross capital debt flows (purchases and sales) of the event and the non-event countries with the U.S. In both cases, we treat the U.S. as the proxy for the world

[11] As a robustness check, we also use an annual average of bilateral trade flows over the year preceding the event and the results are similar with those previously reported.

markets. The first correlation measures economic competition in world trade markets, while the second one quantifies competition in global debt markets. Monthly bilateral trade series of each country in our sample with the U.S. are obtained from the IMF's Direction of Trade Statistics. Monthly debt flow series of each country in our sample vis-à-vis the U.S. are obtained from the U.S. Treasury Bulletin (Treasury International Capital Movements). We compute correlations using the last six months of data prior to the rating event and match them with the two-day CDS spread surrounding the event.[12] We expect the "competition effect" to have a negative impact on the CDS spreads of the non-event countries; that is, the good news will increase the attractiveness of the event country at the expense of all other countries that exert the same level of competition in trade or debt markets.

Alternatively, membership in a trade bloc enhances economic cooperation and integration within the bloc. Consequently, one would expect a positive event in one country of the bloc to have positive effects on other members of the same bloc. In the context of our study, we anticipate that following a positive rating event, CDS premiums decline more sharply for countries that belong to the same trade bloc with the event country. The trade blocs we consider are the Andean Community of Nations (CAN), the Association of Southeast Asian Nations (ASEAN), and the Southern Cone Common Market (Mercosur). We create a trade bloc dummy variable that takes the value of one if the event and the non-event countries belong to the same trade bloc, and zero otherwise.

Could the good credit rating news have spread only among the same rated countries or due to regional proximity? Given the composition of our sample, we cannot rule out this possibility, as the majority of the sovereigns in our sample are rated below investment grade, and

[12] We obtain similar results (not reported) when we use the last 12 months of data.

primarily belong to three geographical regions. Thus, we create two dummy variables: 1) a region dummy that is equal to one if the non-event country belongs to the same region as the event country, and zero otherwise, and 2) a rating dummy that is equal to one if the non-event country belongs to the same rating category as the event country, and zero otherwise. If the spillover is caused by these non-fundamental factors, we anticipate its effect to be stronger within the event country's region or rating category and weaker in other regions or rating categories.

The model we use to test for the importance of transmission channels is an extension of Equation (6) in Section 5.3.

$$\begin{aligned}\Delta CDSspread_{NE,t} = {} & \alpha_0 + \beta_1 Event_{E,t} + \gamma_1 Event_{E,t} * CCR_{NE,t} + \delta_1 Event_{E,t} * CCR_{E,t-1} \\ & + \alpha_2 PriorEvent_{E,t} + \alpha_3 CommonLender_{E,t} + \alpha_4 BilateralTradeFlows_{E,t} \\ & + \alpha_5 TradeFlowsUS_{E,t} + \alpha_6 DebtFlowsUS_{E,t} + \sum_k \alpha_k X_{kNE,t} + \varepsilon'''_{NE,t}\end{aligned} \quad (7)$$

Event and *PriorEvent* are defined in Section 5.3. *CommonLender* is the common lending bank dummy. *BilateralTradeFlows* is the total trade flows (imports plus exports) of the non-event country with the event country expressed as a percentage of the event country's total imports and exports. *TradeFlowsUS* is the correlation between the trade flows (exports plus imports) of the event and non-event countries with the U.S. *DebtFlowsUS* is the correlation between the gross capital debt flows (purchases and sales) of the event and the non-event countries with the U.S. X_k are the trade bloc, region, rating, country, and year dummies. The estimation results are reported in Table 7. The first four rows incorporate each of the new variables separately. In the last row,

we report their effects simultaneously and include the trade bloc, region, and rating dummies. The country and year fixed effects are considered in each model.

Insert Table 7 about here.

Consistent with previous studies (Van Rijckeghem and Weder, 1999; Kaminsky and Reinhart, 2000), we find that the common creditor is a relevant transmission channel. CDS premiums of the non-event countries decline significantly in response to a positive event occurring in a country that shares the same lending bank. A notch upgrade in the credit rating of the event country reduces the average CDS spread of a non-event country 1.49% more if the latter uses the same lending bank as the event country. The common lender retains its significance when all variables are included (row 5).

Competition in trade markets has the anticipated negative effect on CDS markets. CDS premiums of non-event countries increase significantly if the positive event comes from a country that exerts the same level of competition in trade markets. A notch upgrade in the credit rating of the event country increases the average CDS spread of a non-event country by 1.30% if both countries' trade flows with the U.S. are highly correlated. All other variables display no spillover effects. Moreover, the insignificance of the rating and region dummies (row 5) leads us to conclude that the spillover of positive events has an economic basis and is not caused by non-fundamental factors.

6. Summary

This paper examines the response of sovereign CDS markets to a deterioration or improvement in creditworthiness of an emerging economy during the years 2001-2008. We find evidence of an asymmetric reaction of CDS markets to credit rating events. Positive rating

announcements have an immediate impact, while negative rating announcements have no impact on sovereign CDS markets. This finding may suggest that a credit upgrade in emerging economies conveys more information than a credit downgrade. It may also reflect the strong anticipation effect of negative events that allows CDS markets to absorb the effect of the rating news before it is released.

The ability of the CDS premiums to predict a negative event is confirmed by the results obtained with the logistic model. CDS spreads provide useful information when estimating the probability of a negative rating event, but are unable to estimate the probability of an upgrade. An important implication of this finding is that using CDS premiums, market participants can obtain estimates of unfavorable changes in credit quality in emerging markets.

Alternatively, positive ratings announcements are more likely to spill over into other emerging CDS markets than are negative announcements. The magnitude of positive events' spillover effects, however, declines when previous rating announcements are included in the analysis. This finding supports the idea advanced in previous studies that the impact of credit rating events should be analyzed in conjunction with similar events that have occurred recently.

The degree of the spillover effect of the positive events is affected by the credit rating of the non-event country, whereas the degree of the spillover effect of the negative events is affected by the credit rating of the event country. This suggests that credit downgrades of countries with low ratings have more serious consequences than those of middle-rated economies. Therefore, watching credit developments related to low credit quality sovereigns is a necessary measure for good risk management in emerging debt markets.

The transmission mechanisms of the spillover effects we identified are the common creditor and competition in trade markets. An increase in the credit quality of a sovereign has

positive effects on other governments borrowing from the same banking center via increased access to capital. The same increase in the credit quality of an emerging economy, however, has negative consequences for countries that exercise the same level of competition in trade markets.

APPENDIX

Table A.1. Assigning numerical values to S&P's letter credit ratings and outlooks

Credit rating	Numerical value
Letter credit rating	
AAA	17
AA+	16
AA	15
AA-	14
A+	13
A	12
A-	11
BBB+	10
BBB	9
BBB-	8
BB+	7
BB	6
BB-	5
B+	4
B	3
B-	2
CCC+ to CCC-	1
Below CCC-	0
SD (Selective Default)	-1
Credit outlook	
Positive	0.5
Watch Positive	0.25
Stable	0
Watch Negative	-0.25
Negative	-0.5
NM (Not Meaningful)	0

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Table 1. Descriptive statistics of the daily CDS spreads and spread percent changes

Country	Starting period	No. of daily obs.	CDS spread (bps)		CDS spread changes (%)	
			Mean	Stdev	Mean	Stdev
Argentina	2/28/2001	1543	1888.69	2501.95	0.27	4.89
Brazil	1/11/2001	2154	619.31	703.91	0.05	4.08
Chile	2/1/2002	1878	77.97	78.14	0.12	5.28
China	1/2/2001	2161	46.77	42.86	0.09	3.57
Colombia	3/22/2001	2104	395.91	267.97	0.03	3.63
Ecuador	8/1/2002	1419	879.07	795.57	0.21	4.70
Egypt	3/21/2002	1828	220.66	168.52	0.09	3.73
El Salvador	7/29/2002	1510	195.59	134.02	0.12	3.83
Indonesia	12/13/2001	1622	299.16	160.64	0.08	3.84
Israel	4/23/2001	1985	77.14	58.92	0.09	3.26
Korea	3/28/2001	2099	78.43	85.25	0.11	3.97
Lebanon	1/2/2003	1584	448.06	125.77	0.00	2.51
Malaysia	4/23/2001	2082	79.89	66.98	0.08	3.77
Mexico	1/2/2001	2159	155.98	103.40	0.08	3.88
Panama	2/1/2002	1868	250.51	146.50	0.04	3.47
Peru	2/1/2002	1878	308.92	223.65	0.05	3.94
Philippines	3/22/2001	2104	356.81	144.47	0.03	3.08
South Africa	1/11/2001	2142	136.17	96.96	0.08	3.24
Thailand	2/28/2001	2116	81.11	63.08	0.09	3.66
Turkey	1/19/2001	2148	466.76	308.23	0.04	3.54
Venezuela	2/26/2001	2122	778.79	625.20	0.10	3.26
Vietnam	8/6/2002	1277	223.68	152.29	0.10	3.51
Average			*366.61*	*320.65*	*0.09*	*3.76*
Median			*237.09*	*145.49*	*0.08*	*3.69*

Table 2. The distribution of rating events

Panel A. The distribution of rating events per year

	2001	2002	2003	2004	2005	2006	2007	2008	Total
Number of positive events	6	13	15	10	15	16	13	6	94
Number of negative events	21	13	5	0	7	4	2	15	67
Total	27	26	20	10	22	20	15	21	161

Panel B. The distribution of rating events per day

	Number of events per day			
	1	2	3	Total days
Number of days with positive events	85	3	1	89
Number of days with negative events	65	1	0	66
All events	146	6	1	153[1)]

[1)]There are two days with one positive and one negative rating events.

Table 3a. Basic statistics of two-day CDS spread changes and spread percent changes of event countries during rating events

For any rating event in country *i* occurring at time *t*, the two-day (adjusted) CDS spread change and (adjusted) spread percent change are calculated for the period [-1, 1], where day zero is considered the event day. The adjusted CDS spread is the difference between the CDS spread and the spread of an equally weighted portfolio constructed with all reference entities in the sample. A positive event is an upgrade of the S&P's letter credit rating or upward revision in the sovereign's credit outlook. A negative event is a downgrade of the S&P's letter credit rating or downward revision in the sovereign's credit outlook.

	No. obs	Mean	Median	StDev	Skewness	Kurtosis
Panel A: Two-day CDS spread changes (bps)						
Positive events	87	-11.148	-2.770	37.697	-5.266	32.045
Negative events	57	66.816	4.384	260.009	4.884	27.122
Panel B: Two-day CDS spread percent changes (%)						
Positive events	87	-2.230	-2.067	10.504	6.007	48.806
Negative events	57	5.772	0.730	13.338	1.827	2.668
Panel C: Two-day adjusted CDS spread changes (bps)						
Positive events	87	-9.548	-1.521	36.621	-5.316	34.139
Negative events	57	66.086	7.893	264.034	4.799	26.521
Panel D: Two-day adjusted CDS spread percent changes (%)						
Positive events	87	0.902	-0.656	102.302	3.528	40.904
Negative events	57	4.900	2.149	28.474	0.640	5.989

Table 3b. Basic statistics of one-day CDS spread changes of event countries during rating events

For any rating event in country *i* occurring at time *t*, the one-day (adjusted) CDS spread change is calculated separately for periods [-1, 0] and [0, 1], where day zero is considered the event day. The adjusted CDS spread is the difference between the CDS spread and the spread of an equally weighted portfolio constructed with all reference entities in the sample. A positive event is an upgrade of the S&P's letter credit rating or upward revision in the sovereign's credit outlook. A negative event is a downgrade of the S&P's letter credit rating or downward revision in the sovereign's credit outlook. Significance at 1, 5, and 10% levels is denoted by ***, **, and *, respectively.

	Positive events		Negative events	
	One-day CDS spread changes (bps)			
	Period [-1, 0]	Period [0, 1]	Period [-1, 0]	Period [0, 1]
Mean	-6.181**	-4.967***	47.215	19.601
t-test p-val	0.012	0.009	0.114	0.262
Median	-0.945***	-0.881***	4.750***	0.000
Wilcoxon test p-val	0.000	0.000	0.002	0.367
	One-day adjusted CDS spread changes (bps)			
Mean	-5.844**	-3.704*	49.914*	16.173
t-test	0.018	0.057	0.095	0.361
Median	-0.845***	-0.339*	7.436***	4.793*
Wilcoxon test p-val	0.000	0.067	0.000	0.075

Table 4. The proportion of positive and negative CDS spread changes of event countries before and in the period surrounding a rating event.

This table reports the proportion of negative and positive CDS spread changes and adjusted CDS spread changes over the periods [-1, 1], [-30, -1], [-60, -31], and [-90, -61], where the credit rating event date is considered day zero. The last row in each time period presents the chi-square test for equal proportions and p-values. Significance at 1, 5, and 10% levels is denoted by ***, **, and *, respectively.

No. of pos/ neg CDS spread changes	All rating events	Credit rating changes	Outlook changes	All rating events	Credit rating changes	Outlook changes	All rating events	Credit rating changes	Outlook changes	All rating events	Credit rating changes	Outlook changes
	CDS spread changes						*adjusted CDS spread changes*					
	Positive events			*Negative events*			*Positive events*			*Negative events*		
[-1,1]												
Positive	19	5	14	31	10	21	31	8	23	36	9	27
	(21.84%)	(18.52%)	(23.33%)	(54.39%)	(66.67%)	(50.00%)	(35.63%)	(29.63%)	(38.33%)	(63.16%)	(60.00%)	(64.29%)
Negative	68	22	46	26	5	21	56	19	37	21	6	15
	(78.16%)	(81.48%)	(76.67%)	(45.61%)	(33.33%)	(50.00%)	(64.37%)	(70.37%)	(61.67%)	(36.84%)	(40.00%)	(35.71%)
χ^2 test	27.598***	10.704***	17.067***	0.439	1.667	0.000	7.184***	4.482**	3.267*	3.947**	0.600	3.429*
	(0.000)	(0.001)	(0.000)	(0.508)	(0.197)	(1.000)	(0.007)	(0.034)	(0.071)	(0.047)	(0.439)	(0.0641)
[-30,-1]												
Positive	27	8	19	39	10	29	32	8	24	38	10	28
	(31.40%)	(29.63%)	(32.20%)	(73.58%)	(83.33%)	(70.73%)	(37.21%)	(29.63%)	(40.68%)	(71.70%)	(83.33%)	(68.29%)
Negative	59	19	40	14	2	12	54	19	35	15	2	13
	(68.60%)	(70.37%)	(67.80%)	(26.42%)	(16.67%)	(29.27%)	(62.79%)	(70.37%)	(59.32%)	(28.30%)	(16.67%)	(31.71%)
χ^2 test	11.907***	4.482**	7.475***	11.793***	5.333**	7.049***	5.628**	4.482**	2.051	9.981***	5.333**	5.488**
	(0.001)	(0.034)	(0.006)	(0.001)	(0.021)	(0.008)	(0.018)	(0.034)	(0.152)	(0.002)	(0.021)	(0.019)
[-60,-31]												
Positive	29	4	25	30	5	27	31	8	23	28	5	23
	(35.80%)	(16.67%)	(43.86%)	(68.18%)	(62.50%)	(75.00%)	(38.27%)	(33.33%)	(40.35%)	(63.64%)	(62.50%)	(63.89%)
Negative	52	20	32	14	3	9	50	16	34	16	3	13
	(64.20%)	(83.33%)	(56.14%)	(31.82%)	(37.50%)	(25.00%)	(61.73%)	(66.67%)	(59.65%)	(36.36%)	(37.50%)	(36.11%)
χ^2 test	6.531**	10.667***	0.856	5.818**	0.500	9.000***	4.457**	2.667	2.123	3.273*	0.500	2.778*
	(0.0106)	(0.001)	(0.354)	(0.016)	(0.480)	(0.003)	(0.035)	(0.103)	(0.145)	(0.070)	(0.480)	(0.096)
[-90,-61]												
Positive	28	6	22	25	6	19	35	9	21	24	7	17
	(36.36%)	(26.09%)	(40.74%)	(60.98%)	(75.00%)	(57.58%)	(45.45%)	(39.13%)	(38.89%)	(58.54%)	(87.50%)	(51.52%)
Negative	49	17	32	16	2	14	42	14	33	17	1	16
	(63.64%)	(73.91%)	(59.26%)	(39.02%)	(25.00%)	(42.42%)	(54.55%)	(60.87%)	(61.11%)	(41.46%)	(12.50%)	(48.48%)
χ^2 test	5.727**	5.261**	1.852	1.976	2.000	0.758	0.636	1.087	2.667	1.195	4.500**	0.030
	(0.017)	(0.022)	(0.174)	(0.160)	(0.157)	(0.384)	(0.425)	(0.297)	(0.103)	(0.274)	(0.034)	(0.862)

Table 5. The power of (adjusted) CDS spreads in estimating the probability of a rating event

This table summarizes the results of the logistic models. For each reference entity we identify the months in which a rating event occurs, and associate the event month with the (adjusted) CDS spread change in the previous month. The spread change is defined as the difference between the last and the first CDS spreads observed in a month. To avoid contamination, for each reference entity we eliminate the event month that immediately follows another event month. Months with no rating event are the control group in each logistic model. In Model 1 the covariate is the CDS spread change in the month preceding an event. In Model 2 the covariate is the adjusted CDS spread change. For each model, β_0 is the constant and β_1 is the coefficient of the covariate. P-values are reported in parentheses. Significance at 1, 5, and 10% levels is denoted by ***, **, and *, respectively.

	Model 1: CDS spread change			Model 2: adjusted CDS spread change		
	All rating events	Credit rating changes	Outlook changes	All rating events	Credit rating changes	Outlook changes
	Panel A: Positive events			Panel A: Positive events		
β_0	-3.025***	-4.183***	-3.402***	-3.024***	-4.181***	-3.401***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
β_1	-0.047	-0.044	-0.046	-0.055	-0.045	-0.056
	(0.345)	(0.576)	(0.417)	(0.254)	(0.577)	(0.291)
Sample size	1850	1790	1823	1850	1790	1823
Pseudo-R^2	31.32%	14.47%	24.83%	31.31%	14.47%	24.82%
	Panel B: Negative events			Panel B: Negative events		
β_0	-3.652***	-5.212***	-3.889***	-3.647***	-5.257***	-3.871***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
β_1	0.141***	0.204***	0.134**	0.134***	0.248***	0.057
	(0.001)	(0.000)	(0.036)	(0.007)	(0.000)	(0.576)
Sample size	1812	1774	1801	1812	1774	1801
Pseudo-R^2	21.36%	6.84%	18.02%	21.48%	6.76%	18.14%

Table 6. Spillover effects

This table summarizes the coefficient estimates for the pooled model:

$$\Delta CDSspread_{NE,t} = \alpha_0 + \beta_1 Event_{Et} + \gamma_1 Event_{Et} * CCR_{NE,t} + \delta_1 Event_{Et} * CCR_{E,t-1} + \alpha_2 PriorEvent_{Et} + \sum_k \alpha_k X_{kNE,t} + \varepsilon'_{NEt}$$

where $\Delta CDSspread_{NE,t} = \left(CDSspread_{NE,t+1} - CDSspread_{NE,t-1} \right) / CDSspread_{NE,t-1}$, and X_k are country and year dummies. The dependent variable is the two-day CDS spread percentage change of the non-event country for the period [t-1, t+1], where t is the event day. $Event_{E,t}$ is the aggregate change in comprehensive credit ratings of all event countries E at time t. *PriorEvent* is defined as the cumulative comprehensive credit rating changes of event countries in the month before the current event. CCR_E and CCR_{NE} are the comprehensive credit ratings of event and non-event countries, respectively. P-values are presented in parentheses. Significance at 1, 5, and 10% levels is denoted by ***, **, and *, respectively.

Intercept	Event	Event * CCR_E	Event * CCR_{NE}	PriorEvent	Adj. R^2
		Panel A: Positive Events			
2.841***	-1.177*	0.028	0.147*		0.0354
(0.005)	(0.071)	(0.593)	(0.067)		
1.978*	-0.970	0.106*	0.013	0.411***	0.0375
(0.088)	(0.205)	(0.083)	(0.887)	(0.003)	
		Panel B: Negative Events			
3.740***	0.219	0.264**	-0.022		0.0309
(0.001)	(0.789)	(0.016)	(0.835)		
1.287	0.031	-0.108	-0.001	-0.494***	0.0255
(0.281)	(0.967)	(0.322)	(0.989)	(0.004)	

Table 7. Transmission channels for positive events.

This table summarizes the coefficient estimates for the pooled model:

$$\Delta CDSspread_{NE,t} = \alpha_0 + \beta_1 Event_{Et} + \gamma_1 Event_{Et} * CCR_{NE,t} + \delta_1 Event_{Et} * CCR_{E,t-1} + \alpha_2 PriorEvent_{Et} + \alpha_3 CommonLender_{Et}$$
$$+ \alpha_4 BilateralTradeFlows_{Et} + \alpha_5 TradeFlowsUS_{Et} + \alpha_6 DebtFlowsUS_{Et} + \sum_k \alpha_k X_{kNE,t} + \varepsilon'''_{NEt}$$

where $\Delta CDSspread_{NE,t} = \left(CDSspread_{NE,t+1} - CDSspread_{NE,t-1} \right) / CDSspread_{NE,t-1}$, and X_k are trade bloc, region, rating, country, and year dummies.

The dependent variable is the two-day CDS spread percentage change of the non-event country for the period [t-1, t+1], where t is the event day. $Event_{E,t}$ is the aggregate change in comprehensive credit ratings of all event countries E at time t. *PriorEvent* is defined as the cumulative comprehensive credit rating changes of event countries in the month before the current event. CCR_E and CCR_{NE} are the comprehensive credit ratings of event and non-event countries, respectively. The *CommonLender* is a dummy variable that is 1 if the non-event country uses the same international lender as the event country, and 0 otherwise. *BilateralTradeFlows* represents the trade flows of the non-event country with the event country (exports + imports) as a percent of the total exports and imports of the event country. *TradeFlowsUS* is the six-month correlation between the trade flows of the event and non-event countries with the US. *DebtFlowsUS* is the six-month correlation between the gross capital debt flows (sales and purchases) of the event and non-event countries with the US. The trade bloc dummy is 1 if the non-event country belongs to the same trade bloc as the event country, and 0 otherwise. The region dummy is 1 if the non-event country belongs to the same region as the event country, and 0 otherwise. The rating dummy is 1 if the non-event country is in the same rating category as the event country, and 0 otherwise. P-values are presented in parentheses. Significance at 1, 5, and 10% levels is denoted by ***, **, and *, respectively.

Intercept	Event	Event * CCR_E	Event * CCR_{NE}	PriorEvent	Common Lender	Bilateral Trade Flows	Trade FlowsUS	Debt FlowsUS	Trade Bloc Dummy	Region Dummy	Rating Dummy	Adj. R^2
4.179***	-1.190	0.086	0.052	0.412***	-1.489***							0.0445
(0.000)	(0.109)	(0.158)	(0.558)	(0.003)	(0.002)							
3.085***	-1.192	0.107*	0.046	0.414***		0.056						0.0376
(0.000)	(0.112)	(0.080)	(0.607)	(0.003)		(0.584)						
2.988***	-1.205	0.098	0.046	0.421***			1.304***					0.0426
(0.000)	(0.106)	(0.107)	(0.609)	(0.003)			(0.006)					
2.092*	-1.183	0.107*	0.026	0.439***				-0.796*				0.0360
(0.079)	(0.137)	(0.097)	(0.784)	(0.003)				(0.090)				
3.320**	-1.183	0.070	0.032	0.452***	-1.738***	0.058	0.994*	-0.864*	0.477	0.276	0.374	0.0462
(0.011)	(0.137)	(0.282)	(0.732)	(0.002)	(0.001)	(0.628)	(0.052)	(0.066)	(0.341)	(0.620)	(0.464)	

Figure 1. Emerging market CDS spreads

Figure 2. The succession of rating events

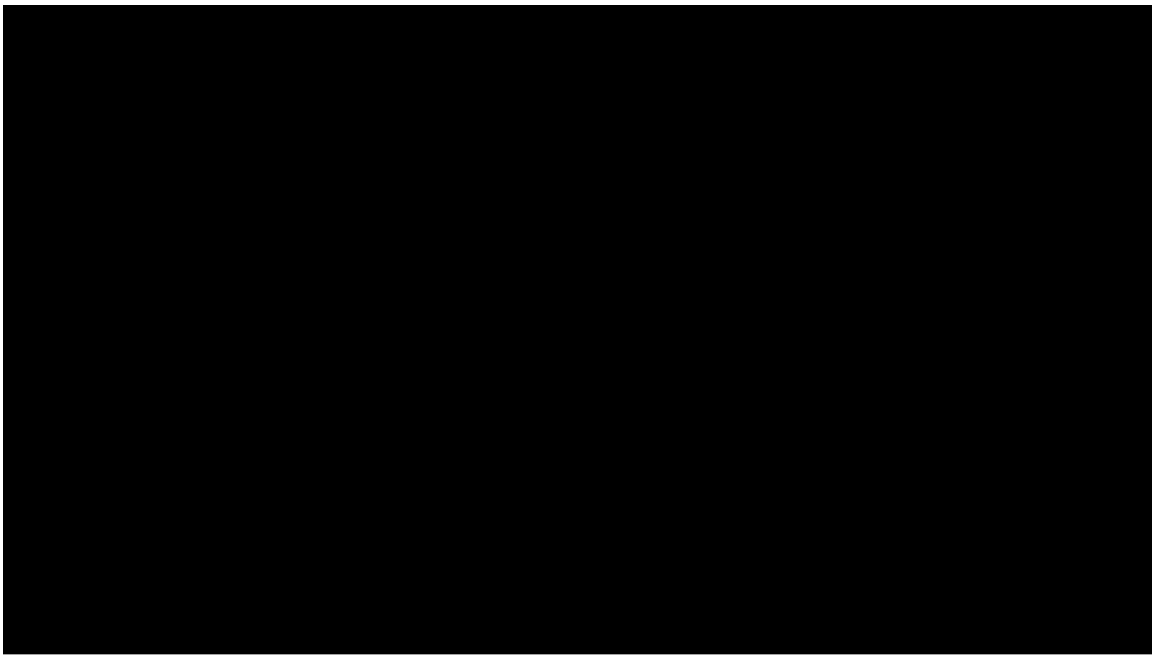

Figure 3. Argentina's CDS spreads before and after the government default on November 6, 2001

Figure 4. Venezuela's CDS spreads before and after the government default on January 18, 2005