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Abstract

We study the effect of a sovereign credit rating change of one country on the sovereign credit spreads of other countries for 155 ratings change events from 1991 to 2000. We find evidence of spillover effects, that is, a ratings change in one country has a significant effect on sovereign credit spreads of other countries. This effect is asymmetric: positive ratings events abroad have no discernable impact on sovereign spreads, whereas negative ratings events are associated with an increase in spreads. On average, a one-notch downgrade of a sovereign bond is associated with a 12 basis point increase in spreads of sovereign bonds of other countries. Interestingly, the magnitude of the spillover effect following a negative ratings change is amplified by recent ratings changes in other countries. Conceptually, we distinguish between *common information* and *competitive* components of spillovers. While common information spillovers imply that sovereign spreads move in tandem, competitive spillovers are expected to result in a differential effect of ratings events across countries. Despite the predominance of common information spillovers, we also find evidence of competitive spillovers among countries with highly negatively correlated capital flows or trade flows vis-à-vis the United States. That is, spreads in these countries generally fall relative to other countries in response to a downgrade of a country with highly negatively correlated capital or trade flows. Variables proxying for cultural or institutional linkages (e.g., common language, formal trade blocs, common-law legal systems), physical proximity, or rule of law traditions across countries do not seem to affect estimated spillover effects.

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1. Introduction

During the 1990s a fundamental shift occurred in the nature of cross-country linkages. While the trend toward trade liberalization continued, many observers have noted that financial flows are now the dominant vehicle of interdependence. Indeed, capital flows have been central in the crises of the Exchange Rate Mechanism (ERM) in 1992, the Tequila crisis in 1994-95, the Asian crisis, and the Ruble crises of the latter half of the 1990s. Moreover, it has been widely documented that, at least during crisis periods, cross-country transmission contributed to financial market turmoil beyond individual country borders.

The purpose of this study is to examine the nature of cross-border financial market linkages more generally (i.e., not just during crisis periods). Typically, studies of spillovers examine co-movements of stock market returns. In the context of contagion, these studies test whether stock market correlations increase during contagious episodes. While the existing literature primarily focuses on stock market contagion,[1] our paper contributes to a virtually non-existent literature on bond market contagion, especially in more general terms (i.e., not just during crisis periods). Empirically, we focus on the transmission of news concerning sovereign credit ratings, to sovereign bonds issued by other countries.

We focus on the sovereign bond market and sovereign credit ratings for the following reasons. First, sovereign debt serves as the benchmark for all other interest rates in the local economy, e.g., cost of corporate borrowings, thus developments in this market have wider implications for credit conditions in general. Second, sovereign spreads reflect the default risk of borrowing countries (in addition to other risks, such as liquidity risks etc.) Thus, conceptually, sovereign debt affords a primary channel for the transmission of spillovers of ratings.

Our primary focus in this study is on the cross-market spillovers of sovereign credit rating changes. In particular, we concentrate on the spillover of a change in the sovereign debt rating or the credit outlook of one country (labeled as an event country), to interest rate spreads (vis-à-vis the interest rate of a U.S. Treasury bond of comparable maturity) on sovereign debt for all *other* countries (labeled as home countries).

Using a daily data set consisting of all publicly traded U.S. dollar denominated sovereign debt, we ask several related questions about observed cross-border spillovers. In particular, we would like to know the size of spillovers — i.e., how much do sovereign spreads react to announcements concerning *other* sovereigns. Second, we ask whether there are asymmetries — i.e., do negative announcements have a quantitatively different impact than positive announcements. Third, can we characterize these spillovers economically? In particular, do historical financial and trade linkages increase or reduce the size of the

[1] There is a vast literature on stock market contagion. Examples of theoretical models include, Allen and Gale (2000), and Kyle and Xiong (2001). On the empirical literature on stock market contagion, there is substantial debate on the definition of contagion as well as its measurement. For example, in contrast to the typical tests of a post-event increase in correlations, Bae et al. (2003) propose a multinomial logistic regression approach to measure contagion. Forbes and Rigobon (2002) draw a conceptual distinction between contagion and interdependence and suggest a sharper empirical test methodology to test for contagion. Also, see Karolyi and Stulz (1996) for an analysis of co-movements, although specifically in the U.S.-Japan stock returns, and Mauro, Sussman, and Yafeh (2002) for an analysis of the co-movement of emerging market yield spreads in the 1990s as compared to 1870-1913, a previous era of global capital market integration.

spillovers? Are spillovers greater between 'similar' countries? Fourth, we also explicitly study the impact of cultural or institutional linkages (e.g., common language, formal trade blocs, common-law legal systems), physical proximity (distance, or adjacency), and rule of law traditions across countries. Finally, we examine whether a sequence of events in separate countries reinforce each other.

In this paper we make a conceptual distinction between *competitive* and *common information* spillovers.[2] In principle, spillovers between two countries may be positive or negative. For example, a positive ratings event, such as an explicit upgrade of the credit rating or an improvement in the credit outlook of a country, may signal a widespread common trend, thus leading to a general lowering of interest rate spreads for all other countries. We refer to this as the common information effect. Alternatively, such good news may reveal that the event country has enhanced its attractiveness at the cost of all other countries, resulting in an increase in interest rate spreads in other countries.[3] We refer to the latter as the competitive effect. Moreover, any given ratings event may contain both common information, and competitive, effects. In these cases, we refer to the net impact. Finally, spillovers may predominately reflect common information, and yet have competitive aspects for some countries only. We explicitly test for these differential effects in our empirical analysis. More formally, we hypothesize that positive (negative) events decrease (increase) sovereign spreads abroad, if the common information effect dominates the competitive effect and vice-versa.

Our primary findings can briefly be summarized. First, we find evidence of spillover effects, that is, ratings change in one country has a significant effect on sovereign credit spreads of other countries. Second, this effect is asymmetric: positive ratings events abroad have no discernable impact on sovereign spreads, whereas negative ratings events are associated with an increase in spreads. On average, a one-notch downgrade of a sovereign bond is associated with a 12 basis point increase in spreads of sovereign bonds of other countries, assuming a 6 per cent yield on a U.S. Treasury of comparable maturity. Third, despite the predominance of common information spillovers, we also find evidence of competitive spillovers — for countries with highly negatively correlated trade or capital flows (vis-à-vis the United States). That is, compared to a typical country experiencing a ratings downgrade, we find a *decrease* of approximately 15 basis points and 13 basis points in the sovereign spreads of similarly downgraded countries having highly negatively correlated capital or trade flows with the U.S.. Fourth, variables proxying for cultural or institutional linkages (e.g., common language, formal trade blocs, common-law legal systems), physical proximity, or on rule of law traditions across countries do not

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2 In their study of bankruptcy announcement spillovers, Lang and Stulz (1992) characterize spillovers as due either to contagion or to competitive effects. In their context, contagion effects are declines in share prices of other (i.e., non-announcing) firms in the industry, while competitive effects convey information about how the announcement impacts the bankrupt firm's competitors. We adopt this conceptual characterization - though in a modified form, since 'contagion', in current usage, typically refers to a post-event increase in correlations. Additionally, there are many examples of such contagion-competitive analysis, although not necessarily in the context of the Lang and Stulz (1992) framework. For example, Bittlingmayer and Hazlett (2000) examine industry spillovers resulting from government anti-trust actions against Microsoft, Eckbo (1983), and Stillman (1983), examine the anticompetitive effects of horizontal mergers. In the banking literature, Slovin, Sushka, and Polonchek (1999) examine contagion and competitive effects at commercial banks, and Saunders (1987) examines contagion effects in the inter-bank market. Also, see Hand, Holthausen, and Leftwich (1992) for an analysis of the effect of bond rating agency announcements on U.S. bond and stock prices. Also see Eichengreen, Rose, and Wyploz (1996) who test whether speculative attacks in one country raise the probability of an attack in another.

3 For example, as a result of a rebalancing of global portfolios toward the upgraded country and away from all other countries with similar risk weightings within the portfolio.

seem to explain the change in the sovereign credit spreads due to credit rating changes abroad. Finally, our results support Kaminsky and Reinhart's (1999) assertion that susceptibility to crises is 'highly nonlinear' more generally. In particular, we find that negative spillovers are amplified by recent ratings change activity.

Our study differs from other studies of the impact of ratings changes on *own* country spreads, e.g., Cantor and Packer (1996), and Reisen and von Maltzan (1999). One potential limitation of studying own country effects is that the 'event window' may be contaminated by other events, i.e., ratings changes in other countries, which can amplify the effect on spreads.[4]

Our study also differs from other studies that identify how news events in one country affect other countries. Kaminksy and Schmukler (1999) examine what type of news moved the markets during the Asian crisis. Baig and Goldfajn (1998) examine spillover effects using daily data for one year during the Asian crisis by categorizing all news events in five Asian economies they study as either 'Good News' or 'Bad News'. In contrast to both these studies, our study estimates the impact on home-country sovereign spreads of specific ratings change events abroad for 34 countries over a ten-year time period that spans crisis and non-crisis time periods.

Our paper also adds to the debate on the information content of sovereign ratings changes. There are two contrasting academic views: on the one hand, sovereign ratings appear to be a sufficient statistic for explaining cross-sectional interest rate spreads (e.g., Cantor and Packer 1996), while these same agencies failed to predict recent large crisis episodes (see, for example, Radelet and Sachs 1998). Ultimately, whether ratings changes convey new information that is relevant across markets is an empirical issue which we examine in this study.

In the next section we describe our data set. In section 3 we discuss our framework for analyzing spillovers in terms of common information versus competitive effects. Section 3 also outlines the testable hypotheses and presents our empirical results. Section 4 concludes.

2. Data

The primary data set we examine consists of daily market-closing observations of the spread over the closest (maturity) matched U.S. government bond for all countries with (currently) publicly traded U.S. dollar denominated sovereign debt. The data cover the period from January 1, 1991 to December 31, 2000, and was compiled from Bloomberg. The only criterion for inclusion in our data set was the existence of publicly traded U.S. dollar denominated sovereign debt as of March 2001. The thirty-four countries meeting this criterion are: Argentina, Austria, Belgium, Brazil, Canada, Chile, China, Colombia, Denmark, Finland, Greece, Hungary, Iceland, Indonesia, Ireland, Israel, Italy, Korea, Lebanon, Malaysia, Mexico, New Zealand, Panama, Philippines, Poland, South Africa, Spain, Sweden, Thailand, Tunisia, Turkey, U.K., Uruguay, and Venezuela.

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[4] Indeed, in our data more than two-thirds of the ratings events occur within 30 days of each other - the typical window length for studies that examine own country spreads.

The time series data on ratings changes for these countries were obtained from the Standard & Poor's (S&P) website. We focus on S&P ratings changes for several reasons. First, Standard and Poor's appears to be more active in making ratings changes, thereby providing a larger data set. For example, in our sample period there were 36 per cent more ratings changes by S&P, than by Moody's. Secondly, other authors have found S&P ratings changes tend not to be anticipated by the market (Reisen and von Maltzan 1999). Finally, in our own comparisons we found that S&P ratings changes preceded Moody's roughly two-thirds of the time.

We also examine lower frequency economic data for these countries. First, we obtain data on bilateral gross capital flows between each country in our sample and the United States. The U.S. Treasury's web site at http://www.treas.gov/tic/ posts bilateral monthly data on flows (purchases and sales) of private and public debt between the U.S. and other countries. For our purposes, we focus on the aggregate bilateral numbers, i.e., sales plus purchases of all short-term public plus private debt. Additionally, we examine data on bilateral trade flows between each country and the United States. Monthly data are available from the Census Department at: http://www.census.gov/foreign-trade/balance/index.html#A.

We also utilize a host of time-invariant country specific data characterizing various cultural, legal, and institutional features of the countries in the sample. First, trade bloc definitions were taken from Frankel (1997). We focus specifically on membership in four primary trade blocs: the North American Free Trade Agreement (Nafta), the Mercado Comun del Sur (Mercosur), the European Union (EU), and the Association of South East Asian Nations (Asean). The legal tradition of each country in our sample is classified by its origin — common law or civil law, and the rule of law tradition. La Porta, Lopez-de-Silanes, Shliefer, and Vishny (1997, 1998) compile and tabulate these variables. In the few instances where our countries were not included in their studies we collected these data from the original sources (Reynolds and Flores 1989, and the International Country Risk Guide at http://www.prsgroup.com).

Classification of countries into emerging/developed is obtained from www.securities.com (a Euromoney web site), the International Finance Corporation's Emerging Markets Factbook 1996, and the S&P Emerging Markets Factbook (2001). The S&P uses an additional classification "Frontier" — these are also counted as emerging. The country is defined as emerging if it is listed as emerging in at least one of these three sources. Additionally, we include bilateral dummy variables for sharing a common language and adjacency. The language dummy takes the value 1 if the country pair shares a common language (either official or primary business language), and zero otherwise. The data was taken from the *CIA World Factbook* (http://www.cia.gov/cia/publications/factbook). We also include an explicit measure of physical distance between countries - computed as the greater-circle distance between countries' capital cities. The latitude and longitude information is available at http://www.un.org/Depts/unsd/demog/392.htm.

Finally, we explicitly control for crisis episodes. Our sample spans the Mexican, Asian, Russian, and Brazilian crises. Collectively, there were 53 ratings events during these crises out of a total of 155 ratings events we consider.

3. Empirical Results

3.1 Preliminary Analysis

The starting point for our analysis is the definition of a rating event (which is often referred to simply as a rating change). One concern is that focusing on implemented ratings changes may be too restrictive. Ratings agencies typically issue secondary announcements that may qualify a country's stated grade. For example, Standard & Poor's frequently puts sovereigns on its 'credit outlook' a few months prior to an actual downgrade. Hence, focusing on the explicit ratings alone (represented by the letter-grade D through AAA) may miss important information. A simple example illustrates this point. If a country that has a particular credit rating (say, BBB) receives a positive credit outlook, and a few months later its prior credit rating is confirmed (i.e., no-upgrade in the explicit credit rating of BBB), in our framework it represents two events, namely upgrade in the credit outlook, and confirmation of prior credit rating (i.e., no-upgrade in the explicit credit rating). Focusing on the explicit credit rating alone would erroneously omit these events. We incorporate this additional information into an 'implicit' credit rating that combines the information in the explicit sovereign credit rating and the information on the credit outlook. Consequently, we define ratings changes (events) more generally to include changes in either the credit rating or the credit outlook.

Events can be positive, such as an upgrade of the explicit credit rating (i.e., letter rating) or an upward revision in the credit outlook of the sovereign, or they can be negative, such as a downgrade of the explicit credit rating or a downward revision in the credit outlook of the sovereign. We combine the information in the explicit credit ratings and the credit outlook into an implicit credit rating (ICR).

We numerically code the letter ratings on a scale from 0 (lowest) through 16 (highest). Similarly, we code the credit outlook on a scale between -1 to +1. Thus, each country's bonds have a rating for each time period; our interest is any nonzero change in the aggregate implicit credit rating of a sovereign. Appendix 1 explicitly tabulates the construction of our implicit credit rating.

In Table 1, we present some data on individual rating change events. There were 155 events between January 1, 1991 and December 31, 2000. According to the table, ratings changes are most commonly announced individually, i.e., for one country at a time, though multiple event days occur for 15 per cent of the cases. Table 1 also splits the sample into positive and negative events. Note that there are approximately equal numbers of positive (78) and negative events (77). During this time period, there were only five days where positive *and* negative ratings announcements were made on the same day. For these five days we focus on the net ratings change; this overlap reduces the number of ratings changes to 150 (= 78 + 77 -5).

In addition to multiple event days, events may be clustered in time. One way to quantify this is the duration between rating changes. Figure 1 presents the time duration between rating change events graphically. From the figure it is apparent that many ratings announcements have been preceded by other ratings announcements. For example, 49 events, or about one-third of the events came within two weeks (ten trading days) of another ratings announcement. Similarly, fully one-half of the events followed other events by three weeks or less.

This temporal association suggests that ratings changes may have different impacts, depending on other ratings change activity. Moreover, failing to account for such clustering may seriously bias the estimated effects of ratings changes — even in studies focusing on own-country effects (e.g., Cantor and Packer 1996, and Reisen and von Maltzan 1999) — since the 'event-window' may be contaminated by spillover effects of ratings changes in other countries. Alternatively, if ratings changes are regarded (by market participants) in the context of recent changes, or if the effects persist beyond a day, part of today's change in spreads will be influenced by prior ratings changes. The importance of considering events in other countries is also highlighted by Kaminsky and Reinhart (1999), among others. Indeed, in our data more than two-thirds of the ratings events occur within 30 days of each other — the typical window length for studies that examine own country spreads. If spillovers exist, the measured own-country effect will be a function of these other events within the window. Figure 2 presents another view of this clustering graphically for both positive and negative events separately. Clearly, there are both 'calm' and 'active' spells in the data; it is an empirical question whether this intensity matters for the reaction of sovereign spreads to these news events.

A related issue pertains to the information content of credit rating events. In their study, Cantor and Packer (1996) demonstrate the high information content of sovereign credit rankings. They show, for example, that ratings have considerable explanatory power for yields (adjusted R^2 of 0.92 of a cross-sectional regression at a point in time in late 1995). Moreover, once macroeconomic explanatory variables (e.g., per capita income, GDP growth, inflation, and the government's fiscal balance) were included in the regression, in addition to the credit ratings, none of the macroeconomic variables were statistically significant, suggesting that ratings subsume information contained in many country specific economic variables. Despite this high explanatory power, the ratings industry has recently been criticized for missing the major crises in the late 1990s. For example, in discussing the Asian crisis, Radelet and Sachs (1998), note that the ratings agencies did not signal increased risk until after the onset of the crisis (indeed some countries were upgraded just prior to the crisis). Reisen and von Maltzan (1999) find some support for this 'follow-the-market' behavior by ratings agencies in their study. However, simultaneous or nearby (temporally) ratings changes make it difficult to isolate the magnitude of the effect of a rating change. As noted above, less than one-third of the ratings events in our data set were not preceded by a rating change in another country within a 30 day window. This may explain why Reisen and von Maltzan find that neither ratings changes nor interest rate spreads uniquely Granger cause the other. Ultimately, whether ratings changes convey new information that is relevant across markets is an empirical issue which we examine in this study.

3.2 Empirical Specification and Benchmark Results

The variable of interest in verifying the existence of spillovers is the interest rate response in country j ($\neq i$) to an event in country i ($\neq j$). We begin by considering changes in the sovereign credit rating and credit outlook, summarized into our composite ICR measure described above. Initially, we measure the interest rate response as the change in the percentage spread, i.e., the interest rate differential over a U.S. Treasury bond of comparable maturity, as a percentage of the relevant U.S. Treasury interest rate. For robustness, we also examine the basis point spread, measured as the interest rate differential in basis

points (i.e., 1/100th of a percentage point) over a U.S. Treasury of comparable maturity. When we have multiple sovereign bonds issued by the same country, e.g., of different maturities, issued at different times, we choose one representative bond with the most time-series observations, to insure greater consistency throughout the sample. We refer to the interest rate response generically as the (change in) spread. We use a standard two-day window [0,1] to incorporate the effects of time-zone differences between the location of the exchange where the sovereign bonds are traded (i.e., London or Luxembourg) and the countries in our sample.[5]

For estimation, we pool the data for all countries (*j*) excluding the event country (*i*), at each event time (t) into two sub-samples, one for positive events, and another for negative events, and for ease of interpretation, we force the sign of $Event_{i,t}$ to be the same for both negative and positive regressions. That is, $Event_{i,t}$ is defined as the absolute value of the aggregate change in implicit credit ratings across all countries, *i*.[6] Overall, our data set has a panel structure: 150 events and 34 countries. Thus, we have a maximum (positive + negative) of 33 x 150 = 4950 data points. However, given that not all countries had data for all 150 events in the sample, the maximum number of observations in our regressions is 2122 (1114 for positive events, and 1008 for negative events).[7] Specifically, we estimate the following regression for both negative and positive events separately.

$$\Delta Spread_{j,t} = a + \beta_1 Event_{i,t} + \sum_k \beta_k X_k + \varepsilon_{ij,t}, \forall j \neq i. \quad (1)$$

Initially, the matrix X_k contains controls for the maturity of the bond, the initial level of the home and event country implicit credit ratings, and full sets of year, and country dummies (34 event, plus 34 home). Subsequently, we consider additional explanatory variables X_k, as well as different definitions of the dependent variable.

Our research design avoids the 'event window' contamination problem described in Section 3.1 in the following manner: first, we measure the dependent variable as the change in the interest rate spread over a short-window (two days), rather than over a benchmark estimated using a longer historical time period, such as 30 days or a few months; second, we control for the intensity of past events as a separate independent variable (i.e., an element of the matrix X_k).

Results from estimating equation 1 are summarized in Table 2. Immediately apparent in the table is the contrast between the results for positive events and those for negative events. For negative ratings events, the estimated sign of β_1 is consistent with the presence of common information effects. That is, negative news for one country translates into increased spreads for all dollar-denominated sovereign debt. However, positive events do not appear to induce statistically significant spillover effects.

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5 That is, while spillovers due to an event (day 0) in the later part of the day in a Western country of our sample, such as Venezuela, will be recorded on day 1 in London/Luxembourg, spillovers due to an event (day 0) in the earlier part of the day in an Eastern country in our sample, such as New Zealand, will be recorded the same day in London/Luxembourg.

6 Note this does not affect our interpretation of the coefficients since we run the positive and negative analysis separately.

7 For example, a few of our sovereign bonds in our sample were issued as late as 1998, making it impossible for us to measure the spillover effects on these bonds of events prior to their issuance, i.e., pre-1998.

One possible explanation for such a direction-specific impact is that positive events are likely to be anticipated (e.g., a local government may have an incentive to leak or preannounce the likelihood of a positive ratings change soon after any favorable discussions with a rating agency), whereas negative events tend to have a larger surprise component due to the absence of similar incentives. Another possible explanation may be a tendency of the rating agencies to maintain the ratings at a higher level, and, consequently they may display reluctance to lowering the sovereign credit rating or the credit outlook. This may arise from fears of losing continued access to critical information, such as the level of foreign currency reserves, etc., which may be privately observed by the foreign governments.[8]

Overall, the results in Table 2 indicate that negative rating changes are more informative than positive events. In particular, the estimated coefficient on β_1 (for negative announcements), indicates that a one-notch cumulative drop in the implicit credit rating during a two-week period is associated with a 12 basis point increase in yields of other country bonds, assuming a 6 per cent yield on a U.S. Treasury bond of comparable maturity.[9]

Next, we explicitly consider whether the relationship is non-linear. Non-linearity, in the sense used by Kaminsky and Reinhart (1999), implies that events in other countries can cumulate; hence an announcement in isolation will have a different impact than one announced in the context of other ratings changes. Empirically, we wish to allow for the cumulative impact of a sequence of time-clustered events, and for the possibility of multiple or offsetting events. We examine this by introducing an additional term into the above specification. This variable measures the net rating change (excluding those in the event country) during the preceding two weeks.[10] For robustness, we also consider one- and three-week windows.

These results — summarized in Table 2 — confirm the nonlinear nature of the relationship. In particular, in the negative events regression, we reject (at the 1 per cent level) the null hypothesis that recent ratings activity does not matter. Moreover, once we control for the context of the ratings change, the estimate of spillovers increases. According to this specification, a negative rating announcement abroad increases spreads by an average of 14 basis points in non-event countries. However, adding these recent ratings events to the positive events regression has no impact on the evidence that positive events are not associated with any spillovers.

To summarize, most sovereign ratings changes are announced singly, however, most sovereign ratings changes are not announced in isolation — indeed, one-third of all announcements occur within two weeks of another announcement. Moreover, this announcement intensity varies through time. We confirm the importance of this intensity for negative ratings changes — that is, both the announcement

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[8] Such a bias has been well documented in the literature on equity analysts. For example, Womack (1996) documents that "... new buy recommendations occur seven times more often than sell recommendations, suggesting that brokers are reluctant to issue sell recommendations."

[9] With unchanged U.S. interest rates (e.g., 6%), 12 basis points $\approx$ 6%* the change in percentage spreads (1.96 $=\hat{\beta}_1$)

[10] For a particular country, ratings changes are not typically revised in quick succession. There were, however, three events that were revised within the two-week window. Since our focus is on spillovers, we exclude own-country events within the window.

and recent prior announcements have explanatory power for the response of sovereign spreads to ratings announcements. Our results also support the hypothesis that there is an asymmetry between the information conveyed by positive events versus negative events. In particular, negative events, such as downgrades and downward revisions in credit outlook appear to be highly informative, while positive events, such as upgrades and upward revisions in credit outlook have no discernable impact on spreads. Finally, the evidence suggests that negative news concerning one country is interpreted broadly as negative news in general — i.e., as common information.

3.3 Economic Basis of Spillovers

Despite the prevalence of common information spillovers, there may be cases where the interest rate response can be opposite in sign — e.g., bad news abroad could lower domestic spreads — perhaps due to a rebalancing of global portfolios. Alternatively, a negative announcement could raise spreads in some countries *relative* to other countries. We attempt to isolate these differential effects by explicitly accounting for linkages among capital and trade flows.[11]

We begin by considering the time-series correlation of gross capital flows (inflows plus outflows vis-à-vis the U.S.) between each country-pair in our sample. For each event, we partition the cross-section into two groups: those country pairs with high positive correlation and those with high negative correlation. Specifically, we use a dummy variable approach to identify countries with highly correlated capital flows. For those countries with highly correlated capital flows (i.e., the top quartile of the empirical distribution) we assign a value of one to the dummy; all other observations are assigned a zero value. We contrast these country pairs with those having high negative correlation (i.e., the bottom quartile of the empirical distribution). Both dummies are included in the regression. Finally, to allow for changing economic fundamentals in, and perceptions of, each foreign country, this correlation is recomputed at every event date using a moving window of capital (and separately, trade) flow data. That is, for each ratings event, we use only the most recent six months to compute the correlation of capital (and trade) flows. Formally, we expect common information spillovers to dominate for countries with highly positively correlated capital (trade) flows and competitive information effects to exist between countries with highly negatively correlated capital (trade) flows.

The results from incorporating these new variables are presented in Table 3. We first present results considering capital and trade flows individually — subsequently we include all four dummy variables simultaneously. First, we find that, as hypothesized, home country spreads decrease (relative to the average) in response to a negative event abroad when capital flows are negatively correlated. The coefficient estimate of -2.55 is statistically significant at the 1 per cent level. That is, compared to a typical country experiencing a ratings downgrade, we find a *decrease* of approximately 15 basis points in the sovereign spreads of similarly downgraded countries having highly negatively correlated capital or trade flows with the U.S.[12] However, we find no such effect for positive events, which is not surprising since we found no evidence of spillovers for positive events in Table 2.

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[11] Note that trade and capital flows do not sum to zero (as in a country's Balance of Payments) because (a) we consider only bilateral flows (vis-à-vis the U.S.), (b) the trade flows do not include services, and (c) official transactions are excluded.

[12] With unchanged U.S. interest rates (e.g., 6%), 15 basis points ≈ 6%* the change in percentage spreads (-2.55).

Moreover, we find that home country spreads decrease (relative to the average) in response to a negative event abroad for countries with highly negatively correlated trade flows. The coefficient estimate of -2.12 is statistically significant at the 5 per cent level, and implies a 13 basis point decrease in home country spreads in response to a one-notch downgrade in the event country.[13] As with capital flows, we find no such effects for positive events.

In Table 4, we add controls for emerging/developed country status, membership in a trade bloc, origin of legal systems, rule of law, adjacency, physical distance between countries, existence of a common language, and for crisis periods. A trade bloc, signifying a formal agreement between countries, serves as a long-term commitment among its members to reduce trade barriers and formally commits its members to a path of increased economic integration within the bloc. An alternative explanation for the formation of trade blocs is that highly integrated countries are more likely to form a bloc. To the extent that member economies are more closely linked, common information spillovers are likely to predominate. Consequently, one would expect a decrease (increase) in spreads to be higher for positive (negative) events associated with countries from the same trade bloc relative to non-trade bloc countries. The sign of the coefficient on our trade bloc variable supports this interpretation, though the coefficient is never statistically different from zero.

This latter conclusion also applies to the additional controls for common language, common-law legal systems, physical proximity (distance, or adjacency), and rule of law traditions. That is, none of the coefficients are statistically different from zero for these variables. In general terms we introduce these additional variables in order to control for historical and time-invariant factors that might affect our conclusions about both the extent of spillovers and their economic basis. In related studies, the importance of these variables has been documented in recent studies of goods market integration (e.g., Rose 2000, Rose and van Wincoop 2001, and Parsley and Wei 2001), and in financial market integration (e.g., La Porta et al. 1998, and Van Rijckeghem and Weder 1999). Adding these additional variables leaves our previous conclusions unchanged. The adjusted R^2 rises in both the positive and negative regressions, however none of the additional variables are statistically significant.

Finally, we introduce a control for crisis periods. Since our data span four crisis periods, and fully one-third of our events occurred during these periods, we are concerned that the results may be driven by a sub-sample of events. The crisis dummy identifies the Mexican peso crisis, the Asian financial crisis, the Russian crisis, and the Brazilian crisis. Again, adding this control to our regression equations (positive and negative) leaves our previous results unchanged. In particular, statistically significant spillovers exist only for negative rating events.

3.4 Robustness and extensions

Next we conduct several robustness checks. First, to address the concern that our results are sensitive to the manner in which we measure spreads, we use a variation of the dependent variable used in the literature, namely basis points spread. To conserve space, we present results only for our final specification including all variables. These results, shown in Table 5, are qualitatively unchanged.

[13] Again, 13 basis points ≈ 6%* the change in percentage spreads (1.20).

In Table 6 we perform the analysis on a reduced set of countries. In principle, we would expect announcements in smaller countries to have less of a spillover impact. Thus, by focusing on larger countries we expect more economically significant spillovers. In particular, we drop the ten smallest countries (i.e., those with purchasing power parity adjusted (1997) GDP < $100 million).[14] As expected, average spillovers are larger for the remaining countries, and trade and capital flow correlations are important for the size of these spillover effects. In particular, a negative event in one of these larger economies raises spreads by 17 basis points as compared to only 13 basis points in the similar regression in Table 4.

In Table 7 we consider recent ratings changes using a longer, i.e., three-week, window. Again, our results are essentially unaffected. In particular, the coefficient estimate for spillovers is virtually unchanged, and the estimate for recent ratings is only slightly smaller than that reported in Table 4.

Finally, it is possible that the spillovers we document are simply a manifestation of the existing correlation structure, i.e., our events may merely demonstrate existing cross-country correlation. A rigorous test of this hypothesis is whether the cross-country returns correlation matrices between event and non-event days are equal. If these matrices are different, then the observed spillovers are not entirely due to the existing correlation structure. We test this hypothesis using the asymptotic χ^2 test proposed by Jennrich (1970). A key feature of his test is that it does not require an assumption that the event and non-event samples (whose correlation matrices are being tested for equality) have equal standard deviations or means. This is important since, as shown by Forbes and Rigobon (2002), typical tests for differences in the pair-wise correlations between contagion and non-contagion periods are biased due to differences in volatilities between the two periods. In contrast, the Jennrich test is applicable even when the means and variances in the two samples are different. The specific details of the test statistic for our case are presented in Appendix 2.

We conduct Jennrich's test for our sample of negative rating events, since these are where we find evidence of spillovers, and to conserve space, we report results only for the percentage spreads sample. We implement the test by randomly (see below) sampling percentage spreads from non-event periods (with replacement), and comparing these to the percentage spreads on event days. Ultimately, we repeat the test 10,000 times and report summary statistics from these tests. For each test, both the event and non-event samples contain an equal number of observations from which the correlation matrices are constructed.[15] Additionally, we impose the sampling restriction that at each event date, our randomly selected non-event date is chosen from among the non-event days preceding the event date. In particular, the corresponding non-event date is taken from (the non-event dates) within the window [-60,-21].

The results from these tests can be easily summarized. The median test statistic from the simulations is 2036.7 while the 5% critical value for the test is 617.2 (for n(n-1)/2 degrees of freedom, where n is the number of countries, which in our case is 34). Thus, the null hypothesis that the correlation matrices

[14] The source for this data was the World Bank publication "World Development Report, 1998-1999". The dropped countries are: Israel, Finland, Hungary, New Zealand, Panama, Ireland, Tunisia, Uruguay, Lebanon, and Iceland.

[15] On two of the negative events days there was also a positive announcement. Consequently, these two days were excluded from the events sample. Hence, the number of returns in the event and the non-event samples is 75.

between the event period and non-event periods are equal is easily rejected. Across all 10,000 tests, we reject the equality null 75 per cent of the time at the 5 per cent level. Thus we are reasonably assured that our results are not simply a reflection of the existing correlation structure; in the majority of cases the correlation structure itself changes on event days.

An additional issue is whether the correlations are higher or lower during the events sample relative to non-event periods. For example, Chakrabarti, and Roll (2002) examine whether regional stock market correlations increased around the Asian financial crisis. For this we examine each of the 10,000 non-event day correlation matrices, and make an element-by-element comparison with the correlation coefficients in the event-days correlation matrix. In particular, we computed the proportion of cross-correlations that were net increases (i.e., percentage of increases minus decreases of element-by-element comparisons of correlations) in the event period as compared to the non-event periods. Surprisingly, we found that there is some evidence of *decreased* correlations during the negative ratings events period — the proportion of net decreases is 2.5 per cent higher than in the non-event samples. This difference is statistically significant at the 1 per cent level. Thus, while we can easily reject the hypothesis that the correlation structure was the same on event- and non-event days, it is not the case that all correlations increased during event-days.

4. Conclusions

This paper examines the extent of cross-border financial market linkages by focusing on the transmission of news events (specifically sovereign credit rating changes) concerning one country to sovereign bond spreads in other countries. We document the existence of asymmetric spillovers: positive ratings events abroad have no discernable impact on the sovereign spreads, whereas negative ratings events are associated with an economically meaningful and statistically significant increase in spreads. We present a framework characterizing these spillovers in terms of common information and competitive effects associated with a ratings change.

While common information events imply that sovereign spreads move in tandem, competitive spillovers are expected to result in a differential effect of ratings events across countries. We find that competitive spillovers exist among countries with highly negatively correlated capital flows or trade flows (vis-à-vis the U.S.). That is, spreads in these countries generally fall (relative to other countries) in response to a downgrade of a country with highly negatively correlated capital or trade flows.

We also confirm the importance of cumulative events, as posited by Kaminsky and Reinhart (1999). In other words, ratings changes should not be viewed as isolated events, and it is appropriate to ask the context in which the change was announced — i.e., have there been other similar ratings changes in the past few days? Finally, we explicitly test whether our results are due to time-invariant historical, economic, institutional, cultural, or location-specific factors, or time-dependent crisis-specific factors. Our conclusions with regard to spillovers remain unaffected.

Our paper has numerous implications for future research. For example, the existence of asymmetric spillovers is consistent with a view that rating agencies may be biased in evaluating sovereigns, e.g., through their reluctance to issue low credit ratings (at initiation), or to lower a credit rating in a timely manner. To explore this issue further, one must examine the incentives of the rating agencies in divulging ratings changes in a timely manner. Additionally, to the extent that large spillovers can be viewed as a precursor to a financial contagion, one can characterize (and possibly forecast) the vulnerability of an economic system to a financial contagion in terms of the aggregate spillovers.

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Table 1: Frequency of ratings events

The following table tabulates the number of events on a single day. The table also segments the sample into positive events and negative events.

Standard & Poor's Ratings

	All Events		Positive Events		Negative Events	
Number of events On a Day	Freq.	Density	Freq.	Density	Freq.	Density
1	128	85.3%	66	84.6%	70	90.9%
2	16	10.7%	8	10.3%	7	9.1%
3	2	1.3%				
4	4	2.7%	4	5.1%		
Total[1]	150		78		77	

Notes:

(1) For the five days having both positive and negative events, the event direction (positive or negative) is determined by the net ratings change. Hence, 150 = 78 +77 -5.

Table 2: Asymmetric Spillover Effects

This table presents the coefficient estimates from the following equation:

$\Delta Spread_{j,t} = a + \beta_1 Event_{i,t} + \beta_2 Prior\ Event_{i,t} + \sum_k \beta_k X_k + \varepsilon_{ij,t}$, $\forall j \neq i$. In the first specification we include only the $Event_{i,t}$, in the second specification we include a measure of recent ratings change activity ($Prior\ Event_{i,t}$,) in the specification. The dependent variable is the cumulative two-day [0,1] change in the percentage spread. Percentage spreads are calculated as the interest rate differential over a U.S. Treasury bond of comparable maturity, as a percentage of the relevant U.S. Treasury interest rate. *Event* is defined as the change in the implicit credit rating. *Prior Event* is defined as the cumulative change in the implicit credit ratings of non-event country bonds during the two weeks preceding the event. The superscripts a, b, and c, imply statistical significance at the 1%, 2.5% and the 5% levels using robust standard errors in a two-tailed test.

	Positive rating events				Negative rating events			
	Coeff	T-stat	Coeff	T-stat	Coeff	T-stat	Coeff	T-stat
Constant	24.092	4.777[a]	24.470	4.852[a]	13.469	0.804	9.427	0.560
Maturity	-0.895	-4.990[a]	-0.909	-5.067[a]	-0.51	-0.894	-0.380	-0.665
Event	0.025	0.135	0.068	0.382	1.960	3.260[a]	2.286	3.512[a]
Prior Event			-0.179	-1.634			0.527	3.000[a]
Implicit Credit Rating (event country)	0.058	1.125	0.094	1.740	0.777	2.873[a]	0.880	3.118[a]
Implicit Credit Rating (non-event country)	-0.026	-0.125	-0.022	-0.107	-0.046	-0.100	-0.022	-0.047
Year Dummies	yes		yes		yes		yes	
Event country dummies	yes		yes		yes		yes	
Home country dummies	yes		yes		yes		yes	
Adjusted R^2	0.134		0.135		0.095		0.098	
Observations	1114		1114		1008		1008	

Table 3: Competitive and Common Information Spillovers - Capital and Trade Flows

This table presents the coefficient estimates from the following equation:

$\Delta Spread_{j,t} = a + \beta_1 Event_{i,t} + \beta_2 Prior\ Event_{i,t} + \sum_k \beta_k X_k + \varepsilon_{ij,t}, \forall j \neq i.$ In this table we sequentially add variables for highly correlated capital flows, and for trade flows. The dependent variable is the cumulative two-day [0,1] change in the percentage spread. Percentage spreads are calculated as the interest rate differential over a U.S. Treasury bond of comparable maturity, as a percentage of the relevant U.S. Treasury interest rate. Event is defined as the change in the implicit credit rating. Prior Event is defined as the cumulative change in the implicit credit ratings of non-event country bonds during the two weeks preceding the event. The superscripts a, b, and c, imply statistical significance at the 1%, 2.5% and the 5% levels using robust standard errors in a two-tailed test.

	Positive rating events				Negative rating events			
	Coeff	T-stat	Coeff	T-stat	Coeff	T-stat	Coeff	T-stat
Constant	24.821	4.866[a]	23.706	4.871[a]	4.172	0.236	12.318	0.802
Maturity	-0.916	-5.080[a]	-0.880	-5.079[a]	-0.160	-0.263	-0.490	-0.947
Event	0.071	0.395	0.058	0.319	2.220	3.472[a]	2.402	3.663[a]
Prior Event	-0.180	-1.639	-0.176	-1.628	0.470	2.656[a]	0.496	2.854[a]
Capital flows — positive	0.257	0.957			-1.150	-1.694		
Capital flows — negative	-0.133	-0.562			-2.551	-2.591[a]		
Trade flows — positive			-0.324	-1.183			0.287	0.427
Trade flows — negative			-0.340	-1.434			-2.120	-2.136[c]
Implicit Credit Rating (event country)	0.092	1.681	0.084	1.571	0.784	3.055[c]	0.889	3.124[a]
Implicit Credit Rating (non-event country)	-0.025	-0.123	-0.030	-0.149	-0.087	-0.186	-0.020	-0.042
Year Dummies	yes		yes		yes		yes	
Event country dummies	yes		yes		yes		yes	
Home country dummies	yes		yes		yes		yes	
Adjusted R^2	0.135		0.136		0.105		0.103	
Observations	1114		1114		1008		1008	

Table 4: Competitive and Common Information Spillovers - Cultural, Legal, Institutional linkages, and Crisis Controls

This table presents the coefficient estimates from equation 1 in the text. In this table we simultaneously add variables for highly correlated trade and capital flows, membership in a trade bloc, home and event country status as emerging/developed, contiguity, distance, common language, origin of legal system, and rule of law. Specifically, we estimate: $\Delta Spread_{j,t} = a + \beta_1 Event_{i,t} + \beta_2 Prior\ Event_{i,t} + \sum_k \beta_k X_k + \varepsilon_{ij,t}, \forall j \neq i.$ The dependent variable is the cumulative two-day [0,1] change in the percentage spread. Percentage spreads are calculated as the interest rate differential over a U.S. Treasury bond of comparable maturity, as a percentage of the relevant U.S. Treasury interest rate. Event is defined as the change in the implicit credit rating. Prior Event is defined as the cumulative change in the implicit credit ratings of non-event country bonds during the two weeks preceding the event. The superscripts a, b, and c, imply statistical significance at the 1%, 2.5% and the 5% levels using robust standard errors in a two-tailed test.

	Positive rating events				Negative rating events			
	Coeff	T-stat	Coeff	T-stat	Coeff	T-stat	Coeff	T-stat
Constant	21.735	4.171[a]	20.697	3.989[a]	11.681	0.661	9.955	0.545
Maturity	-0.859	-5.004[a]	-0.806	-4.691[a]	-0.275	-0.497	-0.153	-0.251
Event	0.058	0.325	0.188	1.133	2.317	3.573[a]	2.207	3.376[a]
Prior Event	-0.149	-1.409	-0.085	-0.768	0.447	2.571[a]	0.485	2.824[a]
Emerging	1.073	1.134	0.510	0.515	-1.709	-0.251	-3.506	-0.504
Developed	-0.587	-0.636	-0.040	-0.040	-10.235	-2.272[b]	-8.477	-1.789
Capital flows — positive	0.311	1.188	0.287	1.094	-1.042	-1.596	-1.083	-1.641
Capital flows — negative	-0.117	-0.493	-0.101	-0.428	-2.617	-2.630[a]	-2.583	-2.653[a]
Trade flows — positive	-0.307	-1.128	-0.282	-1.023	0.154	0.222	0.188	0.267
Trade flows — negative	-0.368	-1.585	-0.380	-1.628	-2.056	-2.195[c]	-1.983	-2.181[c]
Adjacent	0.215	0.307	0.208	0.296	-3.208	-1.440	-3.099	-1.387
Distance	0.000	1.057	0.000	1.069	-0.000	-0.538	-0.000	-0.469
Language	-0.235	-0.977	-0.227	-0.946	0.789	0.940	0.767	0.904
Bloc	-0.526	-1.465	-0.521	-1.452	3.387	1.337	3.419	1.340
Common Law	0.393	1.538	0.385	1.514	0.660	0.567	0.714	0.603
Rule of Law	0.078	0.237	0.082	0.247	-0.472	-0.422	-0.424	-0.387
Crisis			0.749	1.563			-3.121	-1.514
Implicit Credit Rating (event country)	0.077	1.426	0.046	0.784	0.768	2.950[a]	0.715	2.775[a]
Implicit Credit Rating (non-event country)	-0.050	-0.246	-0.054	-0.263	-0.063	-0.137	-0.060	-0.129
Year Dummies	yes		yes		yes		yes	
Event country dummies	yes		yes		yes		yes	
Home country dummies	yes		yes		yes		yes	
Adjusted R^2	0.137		0.138		0.127		0.129	
Observations	1114		1114		1008		1008	

Table 5: Competitive and Common Information Spillovers (Dependent variable measured in basis points)

This table presents the coefficient estimates from equation 1 in the text. In this table we simultaneously add variables for highly correlated trade and capital flows, membership in a trade bloc, home and event country status as emerging/developed, contiguity, distance, common language, origin of legal system, and rule of law. Specifically, we estimate: $\Delta Spread_{j,t} = a + \beta_1 Event_{i,t} + \beta_2 Prior\ Event_{i,t} + \sum_k \beta_k X_k + \varepsilon_{ij,t}, \forall j \neq i.$ The dependent variable is the cumulative two-day [0,1] change in the spread — measured in basis points. Spreads are calculated as the interest rate differential over a U.S. Treasury bond of comparable maturity. Event is defined as the change in the implicit credit rating. Prior Event is defined as the cumulative change in the implicit credit ratings of non-event country bonds during the two weeks preceding the event. The superscripts a, b, and c, imply statistical significance at the 1%, 2.5% and the 5% levels using robust standard errors in a two-tailed test.

	Positive rating events				Negative rating events			
	Coeff	T-stat	Coeff	T-stat	Coeff	T-stat	Coeff	T-stat
Constant	76.921	2.925[a]	70.412	2.681[a]	28.532	0.327	19.898	0.221
Maturity	-3.340	-3.840[a]	-3.008	-3.447[a]	-0.964	-0.363	-0.355	-0.121
Event	0.509	0.612	1.326	1.673	12.585	3.520[a]	12.038	3.344[a]
Prior Event	-0.660	-1.255	-0.260	-0.474	2.082	2.270[b]	2.271	2.502[b]
Emerging	5.576	1.122	2.039	0.398	1.279	0.038	-7.705	-0.223
Developed	-3.798	-0.796	-0.367	-0.072	-56.237	-2.392[b]	-47.441	-1.925
Capital flows — positive	1.962	1.349	1.812	1.245	-5.519	-1.669	-5.722	-1.714
Capital flows — negative	0.072	0.061	0.171	0.143	-12.570	-2.551[b]	-12.402	-2.569[a]
Trade flows — positive	-0.473	-0.323	-0.314	-0.212	1.164	0.342	1.333	0.387
Trade flows — negative	-1.631	-1.338	-1.707	-1.393	-9.032	-1.947	-8.666	-1.922
Adjacent	0.285	0.098	0.239	0.081	-16.641	-1.502	-16.094	-1.450
Distance	0.000	1.910	0.000	1.924	-0.000	-0.316	-0.000	-0.247
Language	-1.049	-0.842	-0.997	-0.803	4.261	1.014	4.148	0.977
Bloc	-0.847	-0.534	-0.813	-0.513	17.681	1.420	17.839	1.423
Common Law	1.635	1.185	0.385	1.514	2.167	0.375	2.438	0.415
Rule of Law	1.073	0.651	1.094	0.662	-1.898	-0.340	-1.659	-0.303
Crisis			4.701	1.822			-15.611	-1.554
Implicit Credit Rating (event country)	0.370	1.346	0.172	0.584	4.033	2.835[a]	3.767	2.661[a]
Implicit Credit Rating (non-event country)	0.104	0.087	0.082	0.069	-0.204	-0.087	-0.185	-0.079
Year Dummies	yes		yes		yes		yes	
Event country dummies	yes		yes		yes		yes	
Home country dummies	yes		yes		yes		yes	
Adjusted R^2	0.091		0.093		0.105		0.106	
Observations	1114		1114		1008		1008	

Table 6: Competitive and Common Information Spillovers (Larger Countries)

This table presents the coefficient estimates from equation 1 in the text for a reduced set of countries, (those with PPP adjusted 1997 GDP >= $100 million). In this table we simultaneously add variables for highly correlated trade and capital flows, membership in a trade bloc, home and event country status as emerging/developed, contiguity, distance, common language, origin of legal system, and rule of law. Specifically, we estimate: $\Delta Spread_{j,t} = a + \beta_1 Event_{i,t} + \beta_2 Prior\ Event_{i,t} + \sum_k \beta_k X_k + \varepsilon_{ij,t}$, $\forall j \neq i$. The dependent variable is the cumulative two-day [0,1] change in the percentage spread. Percentage spreads are calculated as the interest rate differential over a U.S. Treasury bond of comparable maturity, as a percentage of the relevant U.S. Treasury interest rate. Event is defined as the change in the implicit credit rating. Prior Event is defined as the cumulative change in the implicit credit ratings of non-event country bonds during the two weeks preceding the event. The superscripts a, b, and c, imply statistical significance at the 1%, 2.5% and the 5% levels using robust standard errors in a two-tailed test.

	Positive rating events				Negative rating events			
	Coeff	T-stat	Coeff	T-stat	Coeff	T-stat	Coeff	T-stat
Constant	14.497	1.871	14.497	1.856	-29.396	-1.574	-31.271	-1.630
Maturity	-0.667	-2.454[b]	-0.666	-2.390[b]	0.426	0.656	0.574	0.800
Event	0.306	0.887	0.306	0.888	3.162	3.336[a]	2.986	3.083[a]
Prior Event	0.218	1.365	0.218	1.325	0.769	3.132[a]	0.815	3.347[a]
Emerging	2.223	1.420	2.222	1.385	17.0372	2.756[a]	14.484	2.136
Developed	-2.021	-1.288	-2.021	-1.246	-13.740	-2.200[c]	-10.952	-1.589
Capital flows — positive	0.199	0.522	0.199	0.509	-1.637	-1.850	-1.588	-1.793
Capital flows — negative	0.087	0.262	0.087	0.261	-3.409	-2.654[a]	-3.300	-2.688[a]
Trade flows — positive	-0.388	-0.922	-0.388	-0.907	0.254	0.315	0.322	0.390
Trade flows — negative	-0.310	-0.875	-0.310	-0.866	-3.080	-2.183[c]	-2.968	-2.179[c]
Adjacent	-0.213	-0.192	-0.213	-0.192	-1.803	-0.775	-1.635	-0.698
Distance	0.000	0.492	0.000	0.492	0.000	1.484	0.000	1.599
Language	-0.313	-0.875	-0.313	-0.881	2.450	2.279[b]	2.497	2.255[b]
Bloc	-0.796	-1.268	-0.796	-1.268	4.444	1.267	4.469	1.262
Common Law	0.442	0.899	0.442	0.896	0.821	0.534	0.926	0.582
Rule of Law	0.493	0.778	0.494	0.779	-0.841	-0.522	-0.756	-0.483
Crisis			0.002	0.004			-4.051	-1.412
Implicit Credit Rating (event country)	0.127	1.497	0.127	1.446	1.070	2.980[a]	0.991	2.732[a]
Implicit Credit Rating (non-event country)	-0.267	-0.744	-0.267	-0.744	-0.009	-0.017	0.030	0.053
Year Dummies	yes		yes		yes		yes	
Event country dummies	yes		yes		yes		yes	
Home country dummies	yes		yes		yes		yes	
Adjusted R^2	0.281		0.280		0.109		0.111	
Observations	544		544		650		650	

Table 7: Competitive and Common Information Spillovers
(Prior Events during the previous three-weeks)

This table presents the coefficient estimates from equation 1 in the text. In this table we simultaneously add variables for highly correlated trade and capital flows, membership in a trade bloc, home and event country status as emerging/developed, contiguity, distance, common language, origin of legal system, and rule of law. Specifically, we estimate: $\Delta Spread_{j,t} = a + \beta_1 Event_{i,t} + \beta_2 Prior\ Event_{i,t} + \sum_k \beta_k X_k + \varepsilon_{ij,t}$, $\forall j \neq i$. The dependent variable is the cumulative two-day [0,1] change in the percentage spread. Percentage spreads are calculated as the interest rate differential over a U.S. Treasury bond of comparable maturity, as a percentage of the relevant U.S. Treasury interest rate. Event is defined as the change in the implicit credit rating. Prior Event is defined as the cumulative change in the implicit credit ratings of non-event country bonds during the three weeks preceding the event. The superscripts a, b, and c, imply statistical significance at the 1%, 2.5% and the 5% levels using robust standard errors in a two-tailed test.

	Positive rating events				Negative rating events			
	Coeff	T-stat	Coeff	T-stat	Coeff	T-stat	Coeff	T-stat
Constant	19.810	3.871[a]	19.451	3.784[a]	17.093	0.975	15.874	0.885
Maturity	-0.759	-4.494[a]	-0.743	-4.357[a]	-0.450	-0.818	-0.345	-0.573
Event	-0.063	-0.320	0.054	0.309	2.104	3.520[a]	1.978	3.279[a]
Prior Event	-0.304	-2.079[c]	-0.245	-1.785	0.349	1.829	0.398	1.940
Emerging	1.721	3.031[a]	1.515	2.690[a]	-1.271	-0.188	-3.008	-0.437
Developed	-1.193	-2.170[c]	-1.011	-1.790	-10.681	-2.378[b]	-8.983	-1.926
Capital flows — positive	0.306	1.171	0.290	1.104	-0.984	-1.511	-1.021	-1.549
Capital flows — negative	-0.133	-0.560	-0.120	-0.505	-2.767	-2.781[a]	-2.747	-2.805[a]
Trade flows — positive	-0.326	-1.207	-0.305	-1.121	0.043	0.064	0.059	0.088
Trade flows — negative	-0.369	-1.587	-0.376	-1.610	-2.021	-2.184[c]	-1.940	-2.166[c]
Adjacent	0.211	0.301	0.206	0.295	-3.223	-1.439	-3.113	-1.386
Distance	0.000	0.999	0.000	1.016	-0.000	-0.542	-0.000	-0.474
Language	-0.235	-0.978	-0.229	-0.954	0.814	0.968	0.795	0.935
Bloc	-0.560	-1.550	-0.548	-1.517	3.242	1.283	3.257	1.280
Common Law	0.393	1.550	0.386	1.528	0.636	0.545	0.690	0.582
Rule of Law	0.084	0.254	0.085	0.258	-0.469	-0.421	-0.419	-0.386
Crisis			0.521	1.291			-3.187	-1.469
Implicit Credit Rating (event country)	0.060	1.168	0.044	0.842	0.684	2.723[a]	0.623	2.516[b]
Implicit Credit Rating (non-event country)	-0.053	-0.259	-0.054	-0.266	-0.083	-0.177	-0.080	-0.172
Year Dummies	yes		yes		yes		yes	
Event country dummies	yes		yes		yes		yes	
Home country dummies	yes		yes		yes		yes	
Adjusted R^2	0.140		0.140		0.127		0.128	
Observations	1114		1114		1008		1008	

Figure 1: Ratings Announcements

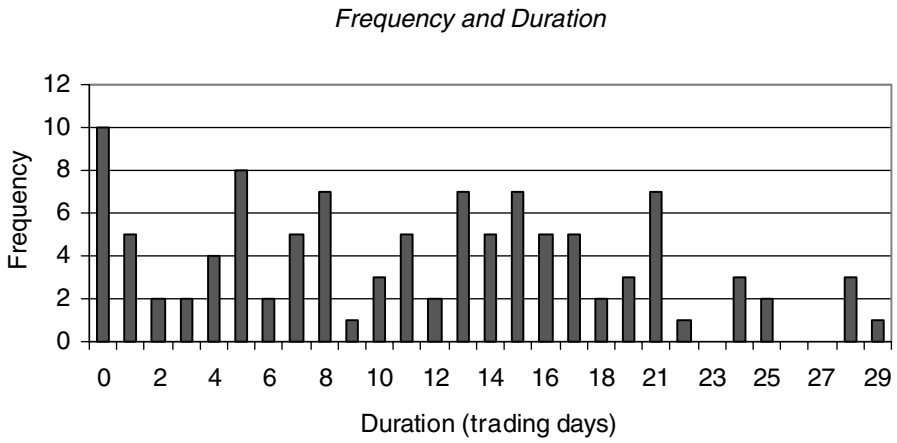
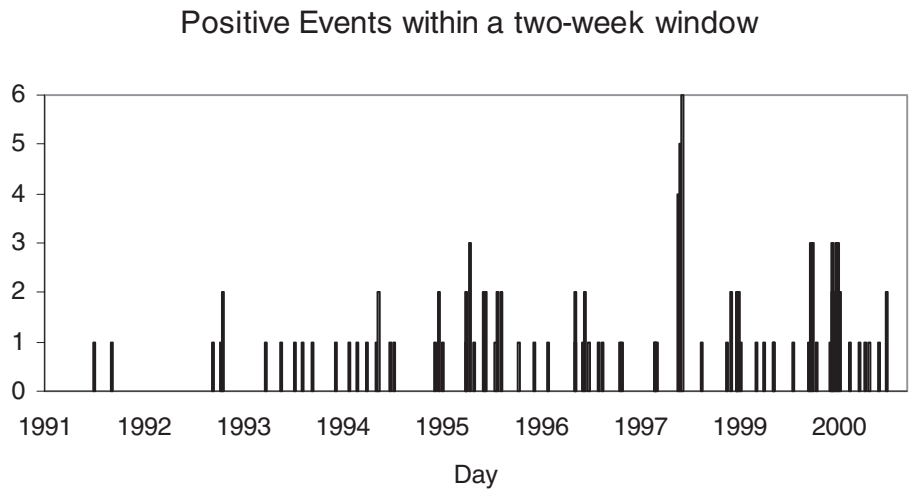
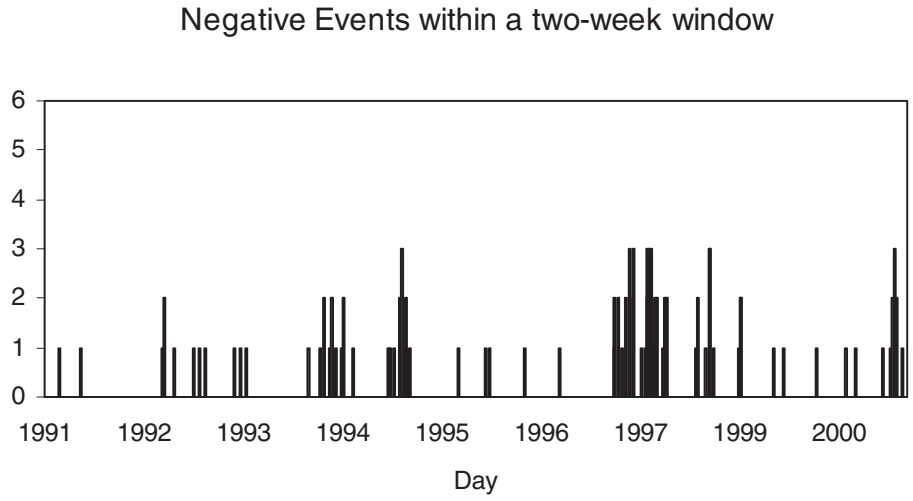


Figure 2





Appendix 1: Implicit Credit Rating Construction

The following appendix presents the construction of the implicit credit rating measure. We code the credit rating from 1 through 16 as follows to obtain the explicit credit rating (ECR). We then add information on the credit outlook to obtain the implicit credit rating (ICR). For example, if a country is rated BB+ with no further information on its credit outlook, its ECR and ICR is 6. If S&P now places the country on watch for a possible upgrade, the ECR is still 6. However, its ICR is 6.50.

Explicit Credit Rating

Sovereign Rating	*ECR*
AAA	16
AA+	15
AA	14
AA-	13
A+	12
A	11
A-	10
BBB+	9
BBB	8
BBB-	7
BB+	6
BB	5
BB-	4
B+	3
B	2
B-	1

Credit Outlook

	Add to ECR
Positive	1
CW-Pos	0.5
Stable	0
CW-Neg	-0.5
Negative	-1

Appendix 2: Jennrich's test statistic

The following appendix provides a brief description of the Jennrich's test statistic for the equality of two correlation matrices. See Jennrich (1970) for additional details of the test statistic. For any two p-variate sample correlation matrices R_1 and R_2 of sizes n_1 and n_2, the Jennrich's test statistic given below is distributed as a χ^2 with p(p-1)/2 degrees of freedom.

$$x^2=\frac{1}{2}tr\,(Z^2) - dg(Z)S^{-1}dg(Z)$$

where,

$$Z = c^{1/2}\bar{R}^{-1}\,(R_1-R_2)$$
$$c = n_1n_2 / (n_1 + n_2)$$
$$\bar{R} = (n_1R_1 + n_2R_2) / (n_1 + n_2)$$
$$S = (\delta_{ij} + \bar{r}_{ij}\bar{r}^{ij})$$
δ_{ij} = Kronecker Delta
$\bar{r}_{ij}$ = Element of $\bar{R}$
$\bar{r}^{ij}$ = Element of $\bar{R}^{-1}$

The expressions 'tr' and 'dg' refer to the trace and diagonal of a matrix respectively.

In the context of this paper, the sample correlation matrices are of percentage spreads during an event period (i.e., negative ratings events) and during a non-event period, selected randomly with replacement from the available data. We repeated this test 10,000 times. See Section 3.4 for additional discussion.