Foreign Exchange Market Reactions and Spillover Effects Following Sovereign Credit Signals

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Abstract

We analyse the reaction of the foreign exchange spot market to sovereign credit signals by Fitch, Moody's and S&P during 1994-2010. We find that positive and negative credit news affects both the own-country exchange rate and other countries' exchange rates. We provide evidence on unequal responses to the three agencies' signals. Fitch signals induce the most timely market responses, and the market also reacts strongly to S&P negative outlook signals. Credit outlook and watch actions and multiple-notch rating changes have more impact than one-notch rating changes. Considerable differences in the market reactions to sovereign credit events are highlighted in emerging versus developed economies, and in various geographical regions.

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1. Introduction

The last three decades have seen many dramatic currency episodes, highlighting the importance of exchange rate behaviour for economic stability and attracting interest in foreign exchange market dynamics. These events include the depreciation of Latin American currencies in the 1980s, the collapse of the Mexican peso in 1994, the crashes of the Turkish Lira in 1994 and 2001, the 1999 currency crisis in Brazil, and the collapse of the currency board in Argentina in 2002. In addition, during the 1997 Asian crisis, unstable exchange rates were partly responsible for the collapse of the trade and other sectors of the economies in Indonesia, Korea and Thailand. The recent global financial crisis was accompanied by exchange rate volatility, including the depreciation–appreciation of the US$ versus the Euro (Loría et al. 2010, Siregar et al., 2010).

Credit rating agencies (CRAs) play a central role in international financial markets through disclosing credit information to market participants, not only via actual rating changes but also via outlook and watch actions. While actual rating upgrades and downgrades have long been the key means available to communicate permanent changes in credit quality, credit outlook and watch are supplemental instruments to signal potential adjustments in issuer credit quality.[1] Prior studies show that outlook and watch signals seem to be at least as important as actual rating changes in their market impact (e.g. Hand et al., 1992; Kaminsky and Schmukler, 2002; Sy, 2004). Each rating agency has a clear reputational goal of providing timely and high quality credit signals to financial markets. Nevertheless, the CRAs have been criticised by politicians and regulators for failing to properly assess the risks in the securities backed by sub-prime mortgages and the subsequent effects on the global economy during the recent financial crisis. In response to the perceived role of CRAs in the financial

[1] Outlooks illustrate an agency's views on the development of a credit rating over the medium term (one- to two-year period), while watchlists are stronger statements that focus on a much shorter time horizon with a typical ex-anti target of three months.

crisis, the International Organization of Securities Commissions (IOSCO) revised the Code of Conduct Fundamentals for CRAs in 2008, and a formal regulation on CRAs was approved in 2009 by the European Parliament. These actions are intended to increase competition in the rating industry, and imply ongoing scrutiny of the relative performance of these agencies.

This paper analyses the relative information content of sovereign credit actions announced by the three major players in the global credit rating industry: Moody's Investors Service, Standard and Poor's (S&P) and Fitch Ratings. Utilizing an extensive data sample for 1994-2010, we examine how the foreign exchange spot market reacts to sovereign credit events for 124 developed and emerging economies, and also investigate spillover effects (i.e. the impact of a sovereign credit signal of one country on other countries' exchange rates). Sovereign ratings are particularly important for emerging economies because risk is greater and information can be of lower quality than for developed economies. Investors usually pay close attention to sovereign ratings when investing capital in emerging countries. Credit risk changes are more frequent in emerging economies and large changes can occur quickly and unpredictably. The role of CRAs is more challenging and problematic in emerging markets.

Many market participants believe that there is added value in multiple ratings (see Baker and Mansi, 2002). Additionally, issuers are more likely to hire an agency if it has a strong reputation in a specific market (Duff and Einig, 2009). We examine relative agency reputations, by investigating whether sovereign credit signals released by a particular CRA have a stronger influence on the foreign exchange spot market than those of other agencies. We also analyse whether any information lead of one agency is associated with specific type of signals, and whether it is evident for developed and/or emerging economies. We expect differences in the information content of the agencies' credit actions for emerging versus developed economies. Alsakka and ap Gwilym (2010) conduct a detailed examination of the relative timeliness of sovereign rating assessments by five CRAs (Moody's, S&P, Fitch, and

two Japanese agencies JCR and R&I), and show that Moody's is the first mover in upgrading sovereigns, while S&P rating changes are the most independent of other agencies.

We focus our analysis on two perspectives: (i) the relative information content of the sovereign actions by the major CRAs for the foreign exchange market, highlighting any informational lead of a given agency in a specific economy (developed or emerging), particular geographical region or a specific type of credit signal (positive versus negative events, and actual rating changes versus outlook actions versus watch announcements); and (ii) the own-country exchange rate responses and the regional spillover effects. We contribute to the existing literature on the market impact of credit ratings in five respects. First, while prior studies on the information content of changes in sovereign credit quality have considered equity and bond markets and currency crises, the literature offers no evidence on foreign exchange market reactions. Second, we provide evidence on both national and regional spillover effects of sovereign credit signals. Third, whereas prior research on the information content of rating agencies' actions has mainly centred on rating changes, we investigate the relative impact of three types of credit signals: actual rating changes, outlook signals and watch events. Fourth, we extend the methodology previously applied in the literature on the information content of credit ratings by employing a logit-type transformation of the numerical-rating scale to account for non-linearity (see Sy, 2004). Finally, there has also been little prior empirical analysis of the relative information content of the credit signals of different CRAs, which is a major goal for this paper.

The main findings are summarized as follows. First, positive and negative sovereign credit signals do affect both the own-country exchange rate and other countries' exchange rates. Second, we provide evidence on unequal responses to the three CRAs' signals. In the case of the own-country exchange rate reactions, we find that Fitch signals induce the most timely reactions, particularly in developed countries, and S&P offers informative negative

outlook signals, especially in emerging economies. Moody's demonstrates an information lead for rating upgrades in developed economies and for rating downgrades in emerging economies, while the reverse is true for S&P. The significant impacts of Moody's positive outlook and watch events (S&P negative watch signals) are only seen in emerging (developed) economies. In addition, the market generally reacts more strongly in the cases of negative news, larger rating adjustments and outlook and watch events.

For regional spillover effects of sovereign credit signals, we find informational leads in favour of: (a) Fitch actions in Latin America, (b) positive actions by Moody's and negative signals by both Moody's and S&P in East and South Asia; and (c) negative events by S&P and Fitch in the Middle East and North Africa and Sub-Saharan Africa. Credit signals from the three CRAs significantly contribute to contagion in Europe and Central Asia, with the exception of Fitch positive events.

The rest of the paper is organized as follows. Section 2 discuses the importance of sovereign ratings and the previous literature on the financial market impact of sovereign rating actions. Section 3 describes the data set of sovereign credit events and foreign exchange rates. Section 4 presents the methodology used to examine the effects of sovereign credit events. Section 5 discusses the empirical results, and Section 6 concludes the paper.

2. Sovereign ratings and market impact

2.1. Sovereign ratings

Foreign-currency sovereign ratings represent assessments of the ability and willingness to generate the foreign exchange necessary to meet the government's debt obligations. The recent global financial crisis has triggered increased interest in the performance of sovereign ratings. The IMF Global Financial Stability Report (April 2010) indicated that sovereign default was the most pressing risk facing the global economy. Sovereign debt concerns have raised doubts about the strength of some European banks,

including in France, Germany and the UK (e.g. Bank of England Financial Stability Report, June 2010). When S&P downgraded Greece's sovereign rating by 3 notches to BB+ from BBB+, with negative outlook, on April 27th 2010, markets in Europe, the UK and the US tumbled. On June 14th 2010, Moody's downgraded Greece's sovereign rating by four notches to Ba1 from A3. In response, the US market reacted with falling stock prices and the euro weakened slightly against the US dollar.

Other valuable aspects of sovereign ratings arise from the fact that sovereign ratings represent a measure of credit risk of a given country, and a ceiling for the ratings assigned to non-sovereign issuers within the country,[2] and they impact directly on a sovereign's cost of borrowing. In addition, the universe of rated sovereigns includes an ever-increasing number of emerging markets. For example, S&P rated 120 sovereigns in 2009 (of which 71 were emerging countries), compared to 50 countries in 1994 (of which only 22 were emerging countries). Sovereign ratings enhance the capability of emerging countries' private sectors to access global capital markets, foster cross-border investment, attract foreign direct investment, and help governments in emerging economies to demonstrate financial transparency (Alsakka and ap Gwilym, 2009).

2.2. Market impact of sovereign ratings

Sovereign rating, outlook and watch signals impact both own-country and international stock and bond markets. Prior studies find strong and significant relationships between sovereign rating downgrades and both a country's equity market return and bond spreads, while upgrades have an insignificant or limited impact (see Cantor and Packer, 1996; Brooks et al. 2004). Sy (2004) shows that S&P and Moody's sovereign rating changes and negative watch and outlook announcements (pooled together) help predict the probability of

[2] Though the ceiling effect is no longer absolute, as Moody's, S&P and Fitch have recently eliminated their sovereign ceiling rule, there remains a 'sovereign ceiling lite' (Borensztein et al., 2007).

distressed debt events. Further, negative (not positive) sovereign rating, outlook and watch actions (pooled together) also cause significant spillovers to other countries' equity and bond markets, particularly in emerging economies, neighbouring countries, and during crisis periods (see Gande and Parsley, 2005; Ferreira and Gama, 2007; Li et al., 2008).

Interestingly, Kaminsky and Schmukler (2002) find that the reactions of bond and stock markets in emerging countries to outlook and watch announcements are stronger than actual rating changes by Moody's, S&P and Fitch (pooled together). An explanation for their findings is that actual rating changes are, to some extent, anticipated since investors are aware of the prior rating outlook/watch status. The asymmetric effect of positive versus negative credit signals may be due to stronger negative reputational impacts for an agency being tardy in the case of downgrades (Alsakka and ap Gwilym, 2010). Issuers may also have an incentive to leak positive news to the market prior to a credit rating upgrade, but have no incentive to do so for negative news prior to a downgrade (Ederington and Goh, 1998). Therefore, negative credit announcements are typically more informative than positive ones.

Some studies have addressed the question of whether sovereign ratings anticipate currency crises. The main finding is that sovereign ratings fail to predict currency crises and are instead adjusted ex-post (e.g. Goldstein et al., 2000; Sy, 2004). One argument in explaining a poor record of sovereign ratings in forecasting currency crises is that rating agencies may not have timely, accurate and comprehensive information on the creditworthiness of the issuer. In addition, agencies may not have enough incentives to downgrade sovereign ratings before a crisis occurs since they are paid by the issuers they rate and a downgrade can precipitate a crisis. Therefore, rating adjustments are a lagging indicator of the crises. The key line of defence provided by CRAs is that ratings represent an assessment of the likelihood of default, not the likelihood of currency crisis.

It is worth noting that most previous market impact studies used data from a single agency only (usually Moody's or S&P) or pooled data from two or three agencies together.[3] However, prior research provides evidence on the unequal reaction to sovereign credit signals across agencies. Cantor and Packer (1996) show that Moody's sovereign rating changes have a larger effect on bond spreads than S&P actions. Brooks et al. (2004) highlight that sovereign upgrades by Moody's only are associated with a positive abnormal stock market return. S&P and Fitch induce a significant stock market reaction only when they downgrade a sovereign rating. Therefore, pooling ratings data from different agencies together (as done by e.g. Kaminsky and Schmukler, 2002; Sy, 2004) may produce misleading results.

If CRAs base their rating actions on publicly available information only, the efficient market hypothesis (EMH) implies that financial markets will not respond to their credit announcements. Hence, to the extent that bond and equity markets are found to react to credit signals (as cited above), this means CRAs incorporate private information which is released into the public domain through credit events (Brooks et al., 2004). The foreign exchange market can incorporate new information very quickly. Consequently, we expect that the sovereign credit signals related to a given country will significantly impact the exchange rate of its own currency. In addition, prior empirical studies provide evidence of the significant effect of exchange rate behaviour on stock market performance (e.g. Dornbusch and Fisher, 1980; Phylaktis and Ravazzolo, 2005). Therefore, we suggest that the foreign exchange market is the channel through which stock market prices and sovereign credit signals are linked. Further, if market participants view credit actions as country specific, little spillover effect would be observed in other exchange rates. On the other hand, financial connections across countries and rational and irrational behaviour of investors can perform as

[3] There is little analysis of the information content of Fitch sovereign actions. Brooks et al. (2004) is the only study that examines financial market (equity and bond) reactions to actual rating changes by Moody's, S&P and Fitch separately (for the period 1973 – 2001).

transmission channels for country shocks and news, especially with the globalized nature of financial markets (Ferreira and Gama, 2007). Therefore, we expect credit information that is incorporated into a given exchange rate to spill over into other countries' exchange rates.

3. Data sample

3.1. Foreign exchange data

The spot foreign exchange market is the largest and most liquid market in the world with a daily trading volume of US$4.0 trillion a day in 2010 (BIS, 2010). The focus of the study is on the response of bilateral exchange rates against the US dollar, given that the USA did not experience any sovereign credit action by the three CRAs during the sample period and the particular importance of the US dollar exchange rate in global financial markets. The exchange rate data is quoted in terms of domestic currency units per one US dollar, and the natural logarithms of the exchange rates are used in the empirical analysis (see Simpson et al., 2005; Fratzscher, 2009). The daily spot foreign exchange rates are obtained from DataStream, and the primary source is Thomson Reuters. With regard to Euro-Zone member countries, data is included in the sample from when they first started using the Euro: (i) From 1 January 1999 for Austria, Belgium, France, Finland, Germany, Ireland, Italy, Luxembourg, Netherlands, Portugal and Spain; (ii) From 1 January 2001 for Greece; (iii) From 1 January 2007 for Slovenia; and (iv) From 1 January 2008 for Cyprus and Malta.

We do not control for the category of exchange rate regime adopted by countries in our sample. Killeen et al. (2006) highlight that news/shocks induce less volatility under fixed rates, and therefore our empirical results are conservative because exchange rates in fixed (floating) regimes are less (more) affected by sovereign credit signals. In fact, classifying exchange rate regimes is itself a controversial task and has become a stand-alone research topic (von Hagen and Zhou, 2007, Dubas et al., 2010). The regimes employed by countries worldwide cover various alternatives, many of which do not fall precisely into the

conventional fixed or floating dichotomy. In addition, the declared exchange rate regimes do not always represent actual policies (von Hagen and Zhou, 2007). The IMF de facto exchange rate classification identifies ten categories, which take into account actual exchange rate performance based on analysis of the information available on countries' de facto arrangements, but are influenced by official declarations (de jure arrangements) (see IMF, 2010). The IMF frequently reclassifies countries based on changes and observed actions. Therefore, the issue of whether a particular exchange rate regime should be considered as fixed or floating is often debatable and is not a focus of our paper.[4]

3.2. Sovereign credit data

We employ the largest dataset on sovereign ratings ever studied in a research paper. This consists of daily observations of long-term (LT) foreign-currency (FC) ratings, outlooks and watchlists of all sovereigns rated by three international credit rating agencies (Moody's, S&P, and Fitch) during the period from 10 August 1994 to 31 July 2010. The sovereign credit ratings data is obtained from InteractiveData Credit Ratings International and each rating action is verified by reference to publications from the three agencies. The sample period starts on 10 August 1994 because Fitch produced its first set of FC sovereign ratings along with rating watch on that date. Fitch started to assign outlook to sovereign LT FC ratings on 21 September 2000. S&P started assigning FC sovereign ratings in January 1961, and implemented the sub-rating categories for AA, A, BBB, and BB from 1973 onwards and then for B and CCC in 1983. S&P was the first agency to commence applying outlook/watch to its ratings in 1989. Moody's produced its first set of FC sovereign ratings in January 1974, and introduced numerical rating modifiers in April 1982. Moody's began employing watchlists in 1991, while outlooks came into extensive use in 1995.

[4] In our sample, 52.9%, 51.8% and 55.5% of countries rated by Moody's, S&P and Fitch, respectively, are in the floating/free floating exchange rate categories based on the end-April 2010 IMF de facto classification (see IMF, 2010).

Table 1 presents summary statistics on the sovereign ratings, outlook and watch data. The daily dataset comprises: 336,317 observations for 104 countries rated by Moody's, 315,308 observations for 112 countries rated by S&P, and 267,213 observations for 101 countries rated by Fitch (Rows 1 and 2). Approximately two-thirds of the total number of observations is related to emerging-economy sovereigns (Row 3).[5] The sample also incorporates: 20,857 (13,522); 44,214 (39,107) and 24,201 (22,015) daily positive (negative) outlook status; and 4,842 (2,994), 0 (2495) and 1337 (3009) daily positive (negative) watch status, assigned by Moody's, S&P and Fitch, respectively (see Rows 5-8). For S&P, there is no watch for possible upgrade. As matter of rating policy, S&P has never placed a sovereign on a watch for possible upgrade (Chambers and Ontko, 2007).

We use two mapped numerical rating scales: (I) a 20-point numerical rating scale (AR) that only includes actual ratings (Aaa/AAA =20, Aa1/AA+ =19, Aa2/AA = 18 …Caa3/CCC- =2, Ca/CC, C/SD-D = 1); and (II) a 58-point numerical comprehensive rating scale (CCR) that incorporates the actual ratings, the credit outlook and the watchlist, as follows: Aaa/AAA =58, Aa1/AA+ =55, Aa2/AA = 52 …Caa3/CCC- =4, Ca/CC, C/SD-D = 1, and we add '+2' for positive watch, '+1' for positive outlook, '-1' for negative outlook, '-2' for negative watch, and '0' for stable outlook and no watch/outlook assignments (see Sy, 2004). In the final numerical class '1' in both scales, the lowest rating categories (Ca/CC, C/SD-D), where the sovereign is in default or the default is imminent, are grouped into one rating class due to very few or no observations in these categories. Each agency has an average rating of comprehensive numerical-rating '36', i.e., between Baa1/BBB+ and Baa2/BBB.

Fig. 1 presents the distribution of daily 20-point numerical ratings of sovereigns for each agency, while Fig. 2 illustrates the distribution of daily comprehensive 58-point numerical ratings. Fig. 2 shows the number of sovereigns with positive/negative outlook and watch

[5] See Section 4 for the definition of emerging economies.

assignments for each rating category (i.e. those sovereigns at ±1 and ±2 surrounding each numerical score of 58, 55, 52, 49, 46 … 10, 7, 4 and 1). Overall, there is a reasonable spread of daily sovereign rating observations across rating categories, with the exception of a high proportion of ratings at the top grade and the small proportion of ratings in categories at the bottom of the rating scale. Many AAA/Aaa (15% of observations approximately) rated sovereigns largely maintain the same rating during the whole sample period. Less than 3% of observations are at the Caa1/CCC+ category and below, because the number of defaulted sovereigns is very low.

Table 1 also describes the sovereign credit signal events for each agency. We identify actual rating changes according to the mapped 20-point numerical ratings by notches on the basis of daily intervals. There are 180 (96) upgrades (downgrades) by Moody's, 213 (162) by S&P, 161 (106) by Fitch (Rows 14 and 20). In all cases, the number of upgrades exceeds the number of downgrades. This derives from a variety of causes fuelling economic growth in 2000-2006, especially in emerging countries, such as higher commodity, oil and natural gas prices, lower-cost production, and larger pools of inexpensive skilled labour.[6] Most of the actual rating changes are by one-notch, representing 73.55%, 86.40% and 84.64% of the total actual rating changes by Moody's, S&P and Fitch, respectively. However, some cases of up to 5(6)-notch rating changes have occurred during the sample period by S&P (Fitch) (see Rows 9-20 of Table 1).

Outlook and watch signals are defined as follows. *Negative watch* signals include placing sovereign *i* on watch for possible downgrade, and the action of confirming the rating of sovereign *i* after being on watch for possible upgrade. *Positive watch* signals include placing sovereign *i* on watch for possible upgrade, and the action of confirming the rating of

[6] Downgrades exceeded upgrades in 2008-2010 as a result of the financial crisis. Sovereign ratings faced growing downgrade pressure (e.g. Greece, Hungary, Iceland, Ireland, Portugal and Spain) as a result of increased public spending.

sovereign *i* after being on watch for possible downgrade. N*egative outlook* signals contain changes to negative outlook from stable/positive outlook, and changes to stable outlook from positive outlook. *Positive outlook* signals contain changes to positive outlook from stable/negative outlook, and changes to stable outlook from negative outlook. Accordingly, the dataset of credit signal events also comprises: 99 (79), 232 (249) and 124 (125) outlook adjustments; and 93 (59), 10 (63), 34 (48) positive (negative) watch announcements by Moody's, S&P and Fitch, respectively (see Rows 22, 23, 25 and 26). S&P released a far higher number of sovereign credit signals (929) than Moody's (606) and Fitch (598). This can be partly explained by S&P's tendency to aim for greater short-term accuracy, and therefore it reverses its actions far more frequently than Moody's or Fitch. The vast majority of signals are announced in isolation, although multiple-event days (i.e. actual rating change and watch/outlook signal simultaneously) occur in 6.60% (40/606) of the total signals by Moody's, 15.29% (142/929) by S&P, and 12.04% (72/598) by Fitch.

We also employ a logit-type transformation of the 58-point numerical rating scale to address the possible existence of non-linearity in the rating scale as follows (see Sy, 2004):

$$LCCR_t = \ln [CCR_t/(59 - CCR_t)]$$

CCR_t is the sovereign rating according to the comprehensive 58-point numerical rating scale. In this case, a non-zero change in the logarithmic comprehensive 58-point numerical rating defines the event of interest: 'positive', an upgrade resulting from an upward move in the letter credit rating of the sovereign and/or from a favourable signal in the credit outlook/watch; 'negative', a downgrade resulting from a downward move in the letter credit rating of the sovereign and/or from an unfavourable signal in the credit outlook/watch.

The variable of interest in verifying the existence of spillovers is the exchange rate response of country *j* to an event of a change in the logarithmic comprehensive 58-point numerical sovereign rating of country *i*. We hypothesise that spillovers are far more likely to

occur within a specific region than between regions, and design the specification accordingly. We apply the World Bank regional classification whereby four regions are considered: Europe and Central Asia (EU-CA), Latin America (LA), East Asia & Pacific and South Asia (E S Asia), and Middle East and North Africa and Sub-Saharan Africa (ME-Af). Sovereigns in the Middle East and North Africa and Sub-Saharan Africa regions are pooled together due to the small number of sovereign credit events in Sub-Saharan Africa. Also, we only consider event days in the regional spillover empirical analysis, i.e. only non-zero values are included (see Gande and Parsley, 2005). For each region's sample, we pool the data of all countries *j* excluding the event country *i* at each event time *t*. Hence, countries that have never experienced any sovereign rating events are not included in sovereign credit events' series, however, their exchange rates are still considered in the foreign exchange rate series in order to examine whether they are affected by sovereign credit signals related to any other countries in the same region.[7] For the 'EU-CA' region that contains the 15 Euro-zone states, all sovereign credit events announced for each of these states are incorporated in the events series, but the Euro-US$ exchange rate is taken into account only once for each sovereign rating event in the EU-CA region.

Table 2 presents the sample's panel structure, consisting of the number of sovereign rating events, the number of countries and number of observations across regions by each agency, which will be used in examining the regional spillover effects. Overall, the maximum number of observations in each region's sample will be equal to 'number of countries x number of events'. However, the actual number of observations is reduced because not all

[7] For example, Switzerland did not experience a sovereign credit event during the sample period, and therefore, does not appear in the sovereign credit events' series. Nevertheless, the Swiss-franks per US$ exchange rate is included in the foreign exchange rate series to examine its responses to sovereign credit signals for other countries in the EU-CA region.

countries were rated at the date of all events during the sample period,[8] and also the issue of Euro-zone member states discussed above.

4. Methodology

To determine the impact of FC sovereign credit signals on the own-country US$ exchange rate, an event study methodology is employed. We first estimate a benchmark regression as follows:

$$\Delta EX_{i,s} = \alpha + \beta_1 \Delta LCCR_{it} + \xi r_i + \gamma y_i + \varepsilon_{it} \qquad \textbf{(Eq. 1)}$$

$\Delta \mathbf{EX_{i,s}}$ is the change in the natural logarithm of the exchange rate of sovereign *i* per US$ in the following time windows (*s*) around the event date *t*: [-1, +1], [-1, +3], [-1, +7], [-1, +14], and [-1, +30]. In order to account for time zone differences, the time windows start at date *t-1*. We measure the change in foreign exchange rates over short windows to control for the potential impact of temporal clustering of events in other countries (i.e. to avoid any information contamination problem). For example, Gande and Parsley (2005) and Ferreira and Gama (2007) use a standard two-day window only.

$\Delta \mathbf{LCCR}_{it}$: 1-day change (day *t* compared with day *t-1*) in the logit-type transformation of the 58- point rating scale of sovereign *i* at event date *t* (see Section 3).

$\mathbf{r_i}$ is a 4×1 vector of dummy variables indicating the geographical region of the country, according to the World Bank regional classification: EU-CA, LA, E S Asia, ME and Af, where EU-CA is used as the reference region.

$\mathbf{y_i}$ is a full set of year dummies.

In the second estimation, we distinguish between the effects of different types of credit signals across agencies (positive events, negative events, one-notch and harsher actual rating changes, outlook and watch announcements) as follows:

[8] The foreign exchange rates for non-event countries are considered commencing from the date that those countries were first rated by that agency.

$$\Delta EX_{i,s} = \alpha + \beta_1 1n-up_{it} + \beta_2 1n-dw_{it} + \beta_3 2n-up_{it} + \beta_4 2n-dw_{it} + \beta_5 PO_{it} + \beta_6 NO_{it} + \beta_7 PW_{it} + \beta_8 NW_{it} + \xi r_i + \gamma y_i + \varepsilon_{it} \quad \textbf{(Eq. 2)}$$

1n-up$_{it}$ (**1n-dw**$_{it}$) is a dummy variable taking the value of 1 if sovereign *i* is upgraded (downgraded) by one notch at time *t*, zero otherwise.

2n-up$_{it}$ (**2n-dw**$_{it}$) is a dummy variable taking the value of 1 if sovereign *i* is upgraded (downgraded) by more than one-notch at time *t*, zero otherwise. There are very few observations at more than two-notch upgrade (downgrade) categories, which are therefore merged together into this category (see Table 1, Rows 9-20).

PO$_{it}$ (**NO**$_{it}$) is a dummy variable taking the value of 1 if sovereign *i* experiences a *positive (negative) outlook* action at time *t*, zero otherwise.

PW$_{it}$ (**NW**$_{it}$) is a dummy variable taking the value of 1 if sovereign *i* experiences a *positive (negative) watch* action at time *t*, zero otherwise.

Equations (1) and (2) are estimated using all sovereigns from each rating agency separately (as presented in Table 1) in order to highlight potential unequal effects across agencies. We also estimate Equation (2) using two sub-samples: (I) sovereigns in emerging economies, and (II) sovereigns in developed economies. These estimations aim to underline any potential informational lead or reputational effect of a particular agency in different economies. To identify 'emerging' economies, the World Bank's country classification, according to countries' GNI per capita, is adopted. All low-income or middle-income countries are defined as 'emerging'.

Finally, we examine whether sovereign credit news of one country *i* has an impact on the exchange rates of other countries *j* in the same region. We follow the modelling approach used by Gande and Parsley (2005) in their investigation of equity market reactions to sovereign credit events. However, we employ a logit-type transformation of the 58-point

numerical ratings to address the possible existence of non-linearity in the numerical rating scale. The specification is:

$$\Delta EX_{j,s} = \alpha + \beta_1 \Delta LCCR_{i,t} + \beta_2 CCR_{it} + \beta_2 CCR_{jt} + \sum_k \xi Co_k + \gamma y_i + \varepsilon_{it} \qquad \textbf{(Eq. 3)}$$

Δ**EX$_{j,s}$:** changes in the natural logarithm of the US$ exchange rate of non-event country *j* in the following time windows (*s*) around the event date *t*: [-1, +1], [-1, +3], [-1, +7], [-1, +14], and [-1, +30].

Δ**LCCR**$_{it}$: 1-day change in the logit-type transformation of the 58-point sovereign rating scale of event country *i* at time *t* (event date).

CCR_{it}: the level of event country *i* comprehensive credit rating.

CCR_{jt}: the level of non-event country *j* comprehensive credit rating.

CCR_{it} and CCR_{jt} are included to control for non-linearity in market reactions relative to the position of each country pair on the 58-point rating scale.

Matrix *Co* includes event country and non-event country dummies.

We estimate Equation (3) using samples of sovereign credit events only (i.e. non-zero values) announced by each rating agency, separately, for sovereigns in four regions: EU-CA, LA, E S Asia and ME-Af (as seen in Table 2). Estimating Equation (3) using sub-samples of sovereigns in four regions allows us to detect any information lead of one agency in each specific region. We examine negative and positive signals separately, which allows for an interpretation of whether foreign exchange rate reactions are in the expected direction, given the signal. For ease of interpretation, the absolute value of Δ**LCCR**$_{it}$ is used in the regression utilising negative credit signals.

An increase in the exchange rate indicates depreciation of the domestic currency value (i.e. more units of domestic currency per 1US$), and vice versa. Therefore, we anticipate positive signs for the coefficients on negative credit signals, while negative signs for the coefficients on positive credit signals in Equations (2) and (3).

5. Empirical results

Section 5.1 discusses the results of the own country exchange rate' responses to sovereign credit signals from the estimation of Equations (1) and (2), which appear in Tables 3-6. Section 5.2 analyses the results of the regional spillover effects of sovereign credit signals from the estimation of Equation (3), which are reported in Tables 7-10.

5.1. Own country exchange rate responses to sovereign credit signals

5.1.1. All economies

Table 3 documents estimates of the coefficients in Equation (1) using data for all sovereigns rated by Moody's in Panel I, by S&P in Panel II and by Fitch in Panel III. The variable of interest is 'ΔLCCR', representing the 1-day change in the logit-type transformation of the 58-point rating scale of sovereign *i* at event date *t*. There is evidence that sovereign credit signals affect foreign exchange markets. Only Fitch sovereign signals show an immediate impact on the own country's exchange rate, i.e. in the [-1, +1] event window. Moody's sovereign actions affect the market within a short time interval, i.e. in the [-1, +3] and [-1, +7] event windows. However the influence in the [-1, +7] event window is stronger and more significant for Fitch actions compared to Moody's (the coefficient absolute values are 1.66 vs. 0.99). The three CRAs provide significant information content to the own-country exchange rate in the [-1, +14] and [-1, +30] event windows, but S&P actions illustrate the weakest effect.

Table 4 reports estimates of the coefficients in Equation (2) using data for all sovereigns rated by each agency. We aim in this analysis to disentangle the effects of various types of sovereign credit signals: one-notch rating upgrades and downgrades, larger (i.e. >1-notch) rating upgrades and downgrades, positive and negative outlook events, and positive and negative watch signals. All significant variables have the expected sign, being negative for positive news and positive for negative news. The significant variables are as follows:

(i) Moody's (Panel I): 1-notch and >1-notch downgrade in all event windows; negative watch announcements in the [-1, +1], [-1, +3] and [-1, +7] event windows; >1-notch upgrade in the [-1, +30] event window, and positive watch signals in the [-1, +14] window.

(ii) S&P (Panel II): Negative outlook signals in all event windows except [-1, +30]; one-notch upgrade in the [-1, +3], [-1, +14] and [-1, +30] event windows; and >1-notch downgrade in the [-1, +30] event window.

(iii) Fitch (Panel III): 1-notch and >1-notch upgrade and downgrade, and positive and negative watch announcements in the [-1, +1] event window; 1-notch upgrade and downgrade in the [-1, +3] and [-1, +7] event windows; >1-notch downgrade in the [-1, +3] event window; and 1-notch downgrade in the [-1, +30] event window.

Consistent with Table 3, Fitch actions have an immediate and significant effect on the exchange rate. In this case, the negative information has much stronger impact than positive, and watch announcements and large rating adjustments have stronger effects than one-notch rating changes. One-notch downgrade, >1-notch downgrade, and negative watch signals by Fitch increase the country's exchange rate (i.e. depreciation in the currency value) by 0.72%, 3.91% and 2.04%, respectively, while one-notch upgrade, >1-notch upgrade, and positive watch signals by Fitch are associated with appreciations in the currency value by 0.10%, 0.29% and 0.40%, respectively.

Similarly, the market reacts more severely for Moody's >1-notch than for one-notch downgrades. The own-country exchange rate responses to Moody's >1-notch downgrades are 1.15% and 1.39% in the [-1, +1] and [-1, +3] event windows, compared to 0.85% and 1.01% in response to Moody's one-notch downgrades. S&P is the only agency which provides significant news to the market through negative outlook announcements. The estimated declines in the currency value as a result of S&P negative outlook signals are: 0.26%, 0.46%,

0.26% and 1.00% in the [-1, +1], [-1, +3] [-1, +7] and [-1, +14] event windows. Rating downgrades and negative watch events by S&P have an insignificant effect.

There is evidence of significant exchange rate responses to rating upgrades by the three CRAs and to positive watch signals by Moody's and Fitch.[9] This highlights important features of the reaction to CRAs' signals in this market compared with bond and stock markets. Brooks et al. (2004) show that upgrades by Moody's only are associated with a limited positive abnormal return, while all other prior market impact studies find ratings upgrades have no effect upon the bond and stock markets (e.g. Sy, 2004; Ferreira and Gama, 2007).

In general, the findings highlight differences in the reaction of the foreign exchange market to positive and negative sovereign credit signals of the three CRAs. We find some evidence of an immediate information lead, through actual rating changes and watch signals, in favour of Fitch relative to both Moody's and S&P. This conflicts with Brooks et al.'s (2004) suggestion that the equity market reaction to sovereign rating changes is greatest for S&P actions. The information lead of Fitch in the foreign exchange market could be explained by Fitch being a European-owned agency (Moody's and S&P have US headquarters). London is the largest foreign exchange market in the world, accounting for 36.7% of global trading, compared to 18% for New York (BIS, 2010). Participants in the London foreign exchange market may pay close attention to Fitch signals.[10] Another potential explanation for the strong reaction to Fitch signals is that the market may require a confirmation of any changes in a sovereign's creditworthiness from a second/third agency before reacting to news provided by one agency. Alsakka and ap Gwilym (2010) find that

[9] Recall that S&P has never placed a sovereign on positive watch list (see Section 3).

[10] There is anecdotal evidence, e.g. from the Financial Times, of the attention placed on Fitch rating actions.

Fitch rating actions follow those of Moody's and S&P, and therefore the may respond immediately to Fitch signals that confirm prior news provided by the other two agencies.

The results also show that significant market reactions to negative outlook signals are demonstrated by S&P only, possibly because of the high number of negative outlook actions provided by S&P (249) compared to Moody's (79) and Fitch (125) (see Row 23 of Table 1). Outlook and watch announcements are associated with stronger effects than in the case of one-notch rating changes, since actual rating changes are, to some extent, anticipated given that they are sometimes preceded by outlook/watch signals. Unsurprisingly, the market reactions are more pronounced in the case of large rating changes and negative credit events.

5.1.2. Emerging economies versus developed economies

Table 5 presents the results of Equation (2) using a sub-sample of sovereigns in emerging economies, while Table 6 reports Equation (2) results using a sub-sample of sovereigns in developed economies.

The Moody's rating downgrade effect is only significant in emerging economies, while the impact of Moody's negative watch signals is only significant in developed economies. Moody's negative watch announcements are associated with a depreciation in currency value by 1.59% and 1.80% in the [-1, +7] and [-1, +14] event windows in developed economies only. In addition, Moody's positive outlook (watch) signals lead to strengthening of the currency by 0.20% (0.50%) in the [-1, +3] ([-1, +14]) event windows in emerging economies only. On the other hand, it appears that large upgrades by Moody's significantly elevate the currency value (i.e. decrease exchange rate) in developed countries by 0.17% in the [-1, +1] event window and 0.14% in the [-1, +3] event window, while Moody's one-notch upgrades are associated with an insignificant impact in emerging economies. See Panel I of Tables 5 and 6.

The significant exchange rate responses for both S&P one-notch upgrades and S&P negative outlook actions (see section 5.1.1 and Panel II of Table 4) prove to be only associated with sovereigns in emerging economies (not developed economies). Interestingly, harsh downgrades by S&P are associated with significant and strong depreciation in the currency value in developed-economies only by 3.59%, 11.42% and 12.62% in the [-1, +7], [-1, +14] and [-1, +30] event windows, respectively. Similarly, S&P negative watch signals lead to significant decline in the currency value in developed-economies only by 2.58%, 2.53%, 2.23%, 3.65% and 5.03% in the [-1, +1], [-1, +3], [-1, +7], [-1, +14], and [-1, +30] event windows, respectively. (Refer to Panel II of Tables 5 and 6).

The immediate exchange rate reactions for Fitch one-notch upgrades, >1-notch upgrades, and positive watch announcements (see section 5.1.1 and Panel III of Table 4) appear to be only associated with sovereigns in developed economies. The immediate downgrade effects are significant in both emerging and developed economies, yet the impact of Fitch downgrades seems to continue over a longer time in emerging economies (see Panel III of Tables 5 and 6).

In summary, the performance of the three CRAs varies considerably in emerging economies versus developed economies. Moody's demonstrates an information lead for rating upgrades in developed economies and for rating downgrades in emerging economies, while vice versa for S&P. The significant impacts of Moody's positive outlook/watch signals and S&P negative outlook events are only relevant to emerging economies. On the other hand, the significant effect of both Moody's and S&P negative watch signals are only seen in developed economies. Further, the immediate market reactions for Fitch upgrades and positive watch announcements appear only in developed economies.

5.2. Regional spillover effects of sovereign credit signals

This section analyses the results of the regional spillover effects of sovereign credit events, from the estimation of Equation (3), in four regions: EU-CA, LA, E S Asia and ME-Af.

Table 7 documents the results of Equation (3) on the regional spillover effect in 'EU-CA' for sovereign credit events by Moody's in Panel I, by S&P in Panel II and by Fitch in Panel III. Positive sovereign credit events by Moody's and S&P (not Fitch) for a particular country incorporate significant information for the currency values of the other countries in 'EU-CA'. The effect is slightly stronger for positive actions by Moody's than S&P, especially for the immediate effect in the [-1, +1] event window (0.22% vs. 0.12% increase in the currency values of non-event countries as a result of a 1% increase in the LCCR of the event country). Negative sovereign credit events by each of the three CRAs contribute to contagion in 'EU-CA'. S&P negative credit events demonstrate the strongest and most significant regional effect. For example, a 1% decrease in the LCCR of the event country by S&P is associated with a 1.40% (0.86%) decline in the currency values of non-event countries in 'EU-CA', compared to 0.18% (0.42%) and 0.29% (0.40%) for Moody's and Fitch in the [-1, +1] ([-1, +3]) event windows.

Table 8 documents the results of Equation (3) on the regional spillover effect in 'LA' for sovereign credit events by Moody's in Panel I, by S&P in Panel II and by Fitch in Panel III. Only Fitch sovereign credit events indicate significant spillover effects on the exchange rate of non-event countries in 'LA'. The non-event countries' exchange rates react more strongly for negative credit events than positive events by Fitch. A 1% increase in the LCCR of the event country by Fitch is associated with a 0.21% (0.13%) appreciation in the currency values of non-event countries in 'LA' in the [-1, +14] ([-1, +7]) event windows. A 1% decrease in LCCR of the event country by Fitch is associated with a 0.53% depreciation in the currency values of non-event countries in 'LA' in the [-1, +14] event window.

Table 9 documents the results of Equation (3) on the regional spillover effect in 'E S Asia' for sovereign credit events by Moody's in Panel I, by S&P in Panel II and by Fitch in Panel III. In contrast with the significant spillover effect of sovereign credit events by Fitch in 'LA', Fitch events do not contribute to contagion in 'E S Asia'. While Moody's and S&P sovereign credit events do not spillover to other countries' exchange rates in 'LA', the exchange rates of non-event countries in 'E S Asia' respond significantly to positive and negative events by Moody's and negative events by S&P. The spillover effect is stronger for negative actions by Moody's than S&P. A 1% decrease in the LCCR of the event country by Moody's is associated with 0.81% and 1.26% depreciations in the currency values of non-event countries in 'E S Asia' in the [-1, +3] and [-1, +7] event windows, compared to a 0.36% depreciation in the [-1, +3] event window in the case of S&P. A 1% increase in the LCCR of the event country by Moody's results in a 0.33% (0.37%) appreciation in the currency values of non-event countries in 'E S Asia' in the [-1, +3] ([-1, +7]) event windows.

Table 10 documents the results of Equation (3) on the regional spillover effect in 'ME-Af' for sovereign credit events by Moody's in Panel I, by S&P in Panel II and by Fitch in Panel III. Moody's credit events lead to an insignificant spillover effect in 'ME-Af'. The exchange rates of non-event countries in 'ME-Af' significantly react to negative sovereign credit events by S&P and Fitch, while their positive events do not contribute to contagion in 'ME-Af'. The results show that a 1% decrease in the LCCR of the event country by Fitch is associated with a 2.74% depreciation in the currency values of non-event countries in 'ME-Af' in the [-1, +3] event window, which is much stronger than the effect of S&P negative events (0.49%).[11]

[11] The results for the [-1, +30] event window estimation of Equation (3) for each region are not presented here in the interests of brevity, but are available on request. The exchange rate responses of non-event countries in the [-1, +30] event window around the event date *t* to Moody's and S&P

Importantly, the level of event country comprehensive credit rating is negative when significant, implying that the higher the event country CCR, the weaker the non-event countries' exchange rate reactions for sovereign credit events. This suggests that the impact of sovereign credit events are most marked for lower credit quality (i.e. emerging market) sovereigns. This is consistent with Ferreira and Gama's (2007) evidence for stock markets.

In brief, the findings indicate that a sovereign credit signal for one country has a significant impact on the foreign exchange rates of other countries, and highlights unequal spillover effects of CRAs' events across the four geographical regions as follows. (i) Negative events by the three CRAs significantly spillover to non-event countries in 'EU-CA', while positive events by Moody's and S&P contribute to contagion in this region; (ii) Only Fitch sovereign credit events spillover to non-event countries in 'LA'; (iii) Positive and negative events by Moody's and negative actions by S&P incorporate valuable information for the exchange rates of non-event countries in 'E S Asia'; and (iv) negative events by S&P and Fitch demonstrate an information lead in 'ME-Af'. The results are only partly in line with evidence on spillover effects of CRAs' signals in stock markets since the significant impact is only found for rating downgrades in those studies (e.g. Gande and Parsley, 2005; Ferreira and Gama, 2007).

6. Conclusion

There is wide interest in empirical research on exchange rates due to their important role in global economic and financial performance. There is prior literature regarding the effects of sovereign rating changes on the bond and equity markets, but there is no prior evidence on the impact of sovereign credit events on the dynamics of foreign exchange markets. In addition, few studies have properly considered the relative information content of

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sovereign credit events are only significant in 'EU-CA'. Fitch credit events never indicate significant spillover effects for this time window across all regions.

sovereign credit actions across the three major CRAs (for any financial market). This paper identifies whether any agency demonstrates an informational lead on the basis of reactions in the own-country exchange rate and other countries' exchange rates to sovereign credit actions. We study three types of credit signals across different economies and geographical regions. We use an extensive sample of daily sovereign ratings and credit outlook and watch assigned for 124 countries by Fitch, Moody's and S&P during 1994-2010. We also apply a logit-type transformation of numerical rating scores to account for potential non-linearity in the comprehensive numerical scale.

There is evidence that sovereign credit signals affect the own-country exchange rate, and that there are unequal reactions to the signals of the three CRAs. We provide some evidence on an immediate information lead in favour of Fitch relative to both Moody's and S&P, which contrasts with evidence from stock and bond markets. We also find a unique market reaction to S&P in the case of negative outlook signals. We identify stronger market reactions to negative versus positive credit signals, and to large rating adjustments and outlook/watch announcements versus one-notch actual rating changes. Actual rating changes are, to some extent, anticipated by the market if they are preceded by outlook or watch signals, and therefore, considering the outlook and watch status of a sovereign is a very important element in assessing the complete credit opinion. Importantly, and in contrast to prior studies on the information content of sovereign credit actions for bond and stock markets, we find significant exchange rate responses to rating upgrades by the three CRAs and to positive watch signals by Moody's and Fitch.

The impact of credit signals varies considerably (and across CRAs) in emerging versus developed economies, as follows. (i) The effects of Moody's rating downgrades and positive outlook and watch signals are only significant in emerging economies, while rating upgrades and negative watch signals by Moody's are only significant in developed

economies; (ii) The effects of upgrades and negative outlook actions by S&P are only significant in emerging economies, while downgrades and negative watch signals by S&P are associated with significant depreciation in currency values in developed economies only; and (iii) The immediate exchange rate responses for upgrades and positive watch signals by Fitch appear only in developed economies.

The results show significant effects of a sovereign credit signal of one country on the foreign exchange rates of other countries (i.e. spillover effects), and we identify inter-agency differences across regions in this case. We provide evidence of a reputation effect in favour of Fitch relative to both Moody's and S&P in 'LA', as Fitch sovereign credit events only spillover to non-event countries in 'LA'. There is a contrast for 'E S Asia', where Moody's positive events demonstrate a lead, yet negative events by both Moody's and S&P contribute to contagion in this region. We find an information lead in favour of negative events by S&P and Fitch relative to Moody's in the 'ME-Af' region. No significant spillover impact is detected for positive events by the three CRAs in 'ME-Af'. Finally, CRA signals significantly spillover to non-event countries in 'EU-CA', with the sole exception of Fitch positive events.

The results presented in this paper offer an important contribution in evaluating and understanding the link between sovereign credit signals and the dynamics of foreign exchange rates. Our evidence on the relative national and international information content of sovereign credit events by the three CRAs will interest many market participants. The findings are also particularly relevant to the credit rating industry given the expectation of increased competition in light of the recent regulatory changes in Europe and North America.

References

Alsakka, R., ap Gwilym, O., 2009. Heterogeneity of sovereign rating migrations in emerging countries. Emerging Markets Review 10, 151-165.

Alsakka, R., ap Gwilym, O., 2010. Leads and lags in sovereign credit ratings. Journal of Banking and Finance 34, 2614 - 2626.

Baker, H. K., Mansi, S. A., 2002. Assessing credit agencies by bond issuers and institutional investors. Journal of Business Finance and Accounting 29, 1367-1398.

BIS, 2010. BIS Triennial Central Bank Survey of foreign exchange and derivatives market activity in April 2010, Bank for International Settlements.

Borensztein, E., Cowan, K., Valenzuela, P., 2007. Sovereign ceiling lite? The impact of sovereign ratings on corporate ratings in emerging market economies. IMF Working Paper.

Brooks, R., Faff, R., Hillier, D., Hillier, J., 2004. The national market impact of sovereign rating changes. Journal of Banking and Finance 28, 233-250.

Cantor, R., Packer, F., 1996. Determinants and impact of sovereign credit ratings. Federal Reserve Bank of New York Economic Policy Review, October, 1-15.

Chambers, J., Ontko, J., 2007. Outlooks: the sovereign credit weathervane, 2006 update. Standard and Poor's Research, New York (April).

Dornbusch, R., Fisher, S., 1980. Exchange rates and the current account. American Economic Review 70, 960-971.

Dubas, J., Lee, B., Mark, N., 2010. A multinomial logit approach to exchange rate policy classification with an application to growth. Journal of International Money and Finance 29, 1438-1462.

Duff, A., Einig, S., 2009. Understanding credit ratings quality: Evidence from UK debt market participants. The British Accounting Review 41**,** 107-119.

Ederington, L. H., Goh, J. C., 1998. Bond rating agencies and stock analysts: Who knows what when?. Journal of Financial and Quantitative Analysis 33, 569–85.

Ferreira, M. and Gama, P., 2007. Does sovereign debt ratings news spill over to international stock markets? Journal of Banking and Finance 31, 3162-82.

Fratzscher, M. 2009. What explains global exchange rate movements during the financial crisis? Journal of International Money and Finance 28, 1390 –1407.

Gande, A., Parsley, D., 2005. News spillovers in the sovereign debt market. Journal of Financial Economics 75, 691-734.

Goldstein, M, Kaminsky, L, Reinhart, M., 2000. Assessing financial volatility: An early warning system for emerging markets. Institute for International Economics, Washington.

Hand, J.R., Holthausen, R.W., Leftwich, R.W., 1992. The effect of bond rating agency announcements on bond and stock prices. Journal of Finance 47, 733–752.

IMF, 2010. Annual report on exchange arrangements and exchange restrictions 2010. International Monetary Fund.

Kaminsky, G., Schmukler, S. 2002. Emerging markets instability: Do sovereign ratings affect country risk and stock returns? The World Bank Economic Review, 16(2), 171−195.

Killeen, W., Lyons, R., Moore, M., 2006. Fixed versus flexible: Lessons from EMS order flow. Journal of International Money and Finance 25, 551-579.

Li, H., Jeon, N., Cho, S., Chiang, C., 2008. The impact of sovereign rating changes and financial contagion on stock market returns: Evidence from five Asian countries. Global Finance Journal 19, 46-55.

Loría, E., Sanchez, A., Salgado, U., 2010. New evidence on the monetary approach of exchange rate determination in Mexico 1994–2007: A cointegrated SVAR model. Journal of International Money and Finance 29, 540–554.

Phylaktis, K., Ravazzolo, F., 2005. Stock price and exchange rate dynamics. Journal of International Money and Finance 25, 1031-1053.

Simpson, M., Ramchander, S. Chaudhry, M., 2005. The impact of macroeconomic surprises on spot and forward foreign exchange markets. Journal of International Money and Finance 24, 693 – 718.

Siregar, R, Pontines, V., Mohd, N., 2010. The US subprime crises and extreme market pressures in Asia. The SEACEN Centre, Flinders University, South Australia.

Sy, A., 2004. Rating the rating agencies: Anticipating currency crises or debt crises? Journal of Banking and Finance 28, 2845-2867.

von Hagen, J., Zhou, J., 2007. The choice of exchange rate regimes in developing countries: A multinomial panel analysis. Journal of International Money and Finance 26, 1071-1094.

Table 1
Descriptive statistics of the sovereign credit data sample

		Moody's	S&P	Fitch
1	No. of countries	104	112	101
2	Total No. of daily observations	336317	315308	267213
3	No. of daily observations in emerging economies	205525	194586	160803
4	No. of daily observations in developed economies	130792	120722	106410
5	No. of daily positive Outlook	20857	44214	24201
6	No. of daily negative Outlook	13522	39107	22015
7	No. of daily positive Watch	4842	0	1337
8	No. of daily negative Watch	2994	2495	3009
9	Number of 1- notch upgrade	138	196	143
10	Number of 2- notch upgrade	34	4	13
11	Number of 3- notch upgrade	8	3	0
12	Number of 4- notch upgrade	0	7	3
13	Number of 5- notch upgrade	0	3	2
14	**Total Upgrades**	180	213	161
15	Number of 1-notch downgrade	65	128	83
16	Number of 2-notch downgrade	22	23	13
17	Number of 3-notch downgrade	7	8	8
18	Number of 4-notch downgrade	2	2	1
19	Number of 5 (6)- notch downgrade	0	1	(1)
20	**Total Downgrades**	96	162	106
21	**Total actual rating changes (Rows 14 + 20)**	**276**	**375**	**267**
22	Positive Outlook Signals	99	232	124
23	Negative Outlook Signals	79	249	125
24	**Total Outlook actions**	**178**	**481**	**249**
25	Positive Watch Signals	93	10	34
26	Negative Watch Signals	59	63	48
27	**Total Watch actions**	**152**	**73**	**82**
28	**Total sovereign credit signals (Rows 21 + 24 +27)**	**606**	**929**	**598**

This Table presents summary statistics for the dataset, which comprises three international rating agencies. The sample consists of daily long-term foreign-currency rating, outlook and watch for all sovereigns rated by each agency during the period of 10 August 1994 to 31 July 2010.

Table 2

Regional distribution of countries and sovereign credit events

	Geographical Region	Moody's			S&P			Fitch		
		No. of Countries	No. of credit events	No. of obs.	No. of Countries	No. of credit events	No. of obs.	No. of Countries	No. of credit events	No. of obs.
1	EU-CA	44	204	5025	45	293	7053	44	240	5925
2	LA	25	155	3192	24	218	3833	18	115	1468
3	E S Asia	19	132	1844	19	189	2572	15	101	1079
4	ME – Af	16	75	1040	24	87	1218	24	70	914
5	**Total**	**104**	**566**		**112**	**787**		**101**	**526**	

This Table presents number of daily sovereign credit events (actual rating changes, outlook actions, watch signals, and an actual rating change simultaneously with a watch/outlook signal) by each agency in four geographical regions: Europe and Central Asia (EU-CA), Latin America (LA), East Asia & Pacific and South Asia (E S Asia) and Middle East and North Africa and Sub-Saharan Africa (ME - Af). The sample period is 10 August 1994 to 31 July 2010.[12]

[12] There are 40, 142 and 72 events of actual rating change simultaneous with watch/outlook signal by Moody's, S&P, and Fitch respectively. Adding these events to Total events in Row 5 of Table 2 gives the 'total sovereign credit signals' observed in Row 28 of Table 1.

Table 3

Own-country exchange rate responses to sovereign credit signals

Event window	**[-1,+1]**		**[-1,+3]**		**[-1,+7]**		**[-1,+14]**		**[-1,+30]**	
	coeff	t-val	coeff	t-val	coeff	t-val	coeff	t-val	coeff	t-val
Panel I- Moody's										
Constant	**0.0006**	2.40	**0.0009**	3.59	**0.0017**	5.68	**0.0030**	8.54	**0.0064**	13.83
ΔLCCR	-0.0032	-1.35	**-0.0070**	-1.67	**-0.0099**	-1.80	**-0.0200**	-2.39	**-0.0297**	-2.28
LA	0.0005	0.57	0.0001	1.03	**0.0002**	1.65	**0.0004**	2.24	**0.0008**	2.82
E S Asia	-0.00001	-0.15	0.0004	0.30	0.0002	0.80	0.0003	1.29	**0.0006**	1.68
ME	**-0.0002**	-4.34	**-0.0003**	-6.00	**-0.0007**	-8.47	**-0.0013**	-11.38	**-0.0028**	-15.99
Af	0.0001	0.79	0.0002	1.27	**0.0005**	1.98	**0.0009**	2.89	**0.0021**	4.24
Year dummies	Yes		Yes		Yes		Yes		Yes	
Adjusted R^2	0.09%		0.20%		0.45%		0.91%		1.84%	
No. of obs.	336317		336114		335710		335003		333387	
Panel II - S&P										
Constant	**0.0005**	2.07	**0.0008**	2.99	**0.0014**	4.61	**0.0025**	6.86	**0.0054**	11.25
ΔLCCR	-0.0019	-0.75	-0.0021	-0.57	-0.0030	-0.70	**-0.0116**	-1.82	**-0.0145**	-1.98
LA	**0.0003**	3.75	**0.0005**	6.00	**0.0010**	9.49	**0.0020**	13.33	**0.0040**	18.30
E S Asia	0.0001	0.67	0.0002	1.53	**0.0005**	2.63	**0.0009**	3.81	**0.0018**	5.25
ME	**-0.0001**	-1.90	**-0.0001**	-2.51	**-0.0003**	-3.50	**-0.0005**	-4.76	**-0.0011**	-7.09
Af	**0.0004**	3.04	**0.0007**	4.42	**0.0015**	6.45	**0.0029**	9.11	**0.0060**	12.67
Year dummies	Yes		Yes		Yes		Yes		Yes	
Adjusted R^2	0.13%		0.30%		0.71%		1.45%		2.96%	
No. of obs.	315308		315092		314660		313904		312176	
Panel III – Fitch										
Constant	**0.0003**	2.70	**0.0007**	3.99	**0.0013**	5.71	**0.0025**	7.9	**0.0062**	12.25
ΔLCCR	**-0.0084**	-2.80	-0.0050	-1.33	**-0.0166**	-2.13	**-0.0212**	-1.65	**-0.0247**	-1.82
LA	**0.0002**	4.02	**0.0005**	5.71	**0.0009**	8.19	**0.0017**	11.00	**0.0035**	14.59
E S Asia	0.0007	0.58	0.0002	1.23	**0.0005**	2.09	**0.0009**	3.03	**0.0018**	4.19
ME	**0.0001**	0.51	0.0002	0.93	**0.0004**	1.75	**0.0008**	2.37	**0.0017**	3.73
Af	0.0002	0.68	0.0005	1.31	**0.0009**	2.48	**0.0018**	4.33	**0.0036**	7.55
Year dummies	Yes		Yes		Yes		Yes		Yes	
Adjusted R^2	0.08%		0.21%		0.58%		1.26%		2.83%	
No. of obs.	267213		267019		266631		265952		264400	

The table presents the coefficient estimates of Eq. (1). The dependent variable is $\Delta\mathbf{EX}_{i,s}$**:** the change in the natural logarithm of the exchange rate of sovereign *i* per US$ in the following time windows (*s*) around the event date *t*: [-1, +1], [-1, +3], [-1, +7], [-1, +14], and [-1, +30]. $\Delta\mathbf{LCCR}_{it}$ is 1-day change in the logit-type transformation of the 58-point rating scale of sovereign *i* at event date *t*. Region dummy variables indicating the geographical region of the country are included: Latin America (LA), East Asia & Pacific and South Asia (E S Asia), Middle East and North Africa (ME) and Sub-Saharan Africa (Af), where Europe and Central Asia (EU-CA) is used as the reference region. A full set of year dummies is included. We apply Huber-White robust standard errors. The 'bold' coefficients are significant at the 10% level at least.

Table 4

Own-country exchange rate responses to sovereign credit signals – Various signal types – All countries

Event window	**[-1,+1]**		**[-1,+3]**		**[-1,+7]**		**[-1,+14]**		**[-1,+30]**	
	coeff	t-val	coeff	t-val	coeff	t-val	coeff	t-val	coeff	t-val
Panel I- Moody's										
Constant	**0.0006**	2.39	**0.0009**	3.57	**0.0017**	5.66	**0.0030**	8.52	**0.0064**	13.81
1n-up	-0.0005	-0.77	0.0002	0.21	-0.0013	-0.78	-0.0006	-0.26	-0.0038	-1.49
2n-up	-0.0008	-0.85	-0.0008	-0.80	0.0001	0.04	-0.0002	0.08	**-0.0040**	-1.67
PO	-0.0009	-1.36	-0.0011	-1.10	-0.0013	-0.95	-0.0013	-0.80	-0.0012	-0.45
PW	0.0007	0.68	0.0004	0.25	-0.0017	-1.13	**-0.0032**	-1.68	0.0024	0.38
1n-dw	**0.0085**	2.06	**0.0101**	2.44	**0.0166**	2.01	**0.0361**	2.00	**0.0438**	1.66
2n-dw	**0.0115**	1.87	**0.0139**	1.69	**0.0175**	1.71	**0.0357**	2.00	**0.0718**	2.31
NO	-0.0032	-0.97	-0.0043	-0.90	-0.0010	-0.15	-0.0051	-0.80	-0.0075	-0.72
NW	**0.0037**	1.70	**0.0049**	1.71	**0.0059**	1.73	0.3316	0.66	0.0170	1.55
Region dummies	Yes		Yes		Yes		Yes		Yes	
Year dummies	Yes		Yes		Yes		Yes		Yes	
Adjusted R^2	0.10%		0.22%		0.46%		0.92%		1.86%	0.10%
No. of obs.	336317		336114		335710		335003		333387	336317
Panel II - S&P										
Constant	**0.0005**	2.06	**0.0008**	2.98	**0.0005**	2.06	**0.0025**	6.85	**0.0054**	11.25
1n-up	-0.0012	-1.53	**-0.0017**	-1.85	-0.0012	-1.53	**-0.0031**	-1.93	**-0.0037**	-1.95
2n-up	0.0052	0.78	0.0036	0.51	0.0052	0.78	0.0018	0.22	-0.0071	-0.50
PO	0.0017	0.55	0.0019	0.61	0.0017	0.55	0.0017	0.53	0.0024	0.67
PW	-0.0096	-1.39	-0.0079	-1.41	-0.0096	-1.39	-0.0106	-0.67	-0.0252	-1.10
1n-dw	0.0048	1.39	0.0086	1.43	0.0048	1.39	0.0101	1.48	0.0103	1.13
2n-dw	-0.0057	-0.90	-0.0018	-0.19	-0.0057	-0.90	0.0875	1.57	**0.1188**	1.99
NO	**0.0026**	1.86	**0.0046**	2.01	**0.0026**	1.86	**0.0100**	1.83	0.0086	1.24
NW	0.0139	1.51	0.0043	0.38	0.0139	1.51	0.0148	1.21	0.0280	1.48
Region dummies	Yes		Yes		Yes		Yes		Yes	
Year dummies	Yes		Yes		Yes		Yes		Yes	
Adjusted R^2	0.16%		0.32%		0.71%		1.52%		3.01%	
No. of obs.	315308		315092		314660		313904		312176	
Panel III – Fitch										
Constant	**0.0003**	2.68	**0.0007**	3.97	**0.0013**	5.70	**0.0025**	7.89	**0.0062**	12.22
1n-up	**-0.0010**	-1.74	**-0.0021**	-2.70	**-0.0025**	-2.26	-0.0018	-1.15	-0.0025	-1.03
2n-up	**-0.0029**	-1.69	-0.0008	-0.90	0.0009	0.29	0.0007	0.12	-0.0027	-0.35
PO	0.0007	0.75	0.0008	0.62	-0.0013	-0.94	0.0001	0.06	-0.0023	-0.81
PW	**-0.0040**	-1.83	-0.0012	-0.65	-0.0050	-0.79	-0.0580	-0.61	-0.0071	-0.55
1n-dw	**0.0072**	1.91	**0.0126**	2.35	**0.0090**	1.82	0.0165	1.44	**0.0363**	2.05
2n-dw	**0.0391**	2.86	**0.0395**	2.76	0.0602	1.43	0.0631	1.56	0.0534	1.22
NO	0.0004	0.22	-0.0008	-0.33	0.0058	1.48	0.0030	0.64	-0.0039	-0.58
NW	**0.0204**	2.01	0.0120	0.96	0.0103	0.73	0.0255	0.93	0.0370	1.36
Region dummies	Yes		Yes		Yes		Yes		Yes	
Year dummies	Yes		Yes		Yes		Yes		Yes	
Adjusted R^2	0.12%		0.23%		0.62%		1.28%		2.85%	
No. of obs.	267213		267019		266631		265952		264400	

The table presents the coefficient estimates of Eq. (2) using the entire data sample by each agency. The dependent variable is $\Delta\mathbf{EX_{i,s}}$, see Table 3 for definition. $\mathbf{1n\text{-}up}_{it}$ ($\mathbf{1n\text{-}dw}_{it}$) takes the value of 1 if sovereign *i* is upgraded (downgraded) by one-notch at time *t*, zero otherwise. $\mathbf{2n\text{-}up}_{it}$ ($\mathbf{2n\text{-}dw}_{it}$) takes the value of 1 if sovereign *i* is upgraded (downgraded) by more-than-one-notch at time *t*, zero otherwise. $\mathbf{PO}_{it}$ ($\mathbf{NO}_{it}$) takes the value of 1 if sovereign *i* experiences a *positive (negative) outlook* action at time *t*, zero otherwise. $\mathbf{PW}_{it}$ ($\mathbf{NW}_{it}$) takes the value of 1 if sovereign *i* experiences a *positive (negative) watch* action at time *t*, zero otherwise. Region dummies and year dummies are included. We apply Huber-White robust standard errors. The 'bold' coefficients are significant at the 10% level at least.

Table 5

Own-country exchange rate responses to sovereign credit signals – Emerging Economies, Eq. (2)

Event window	**[-1,+1]**		**[-1,+3]**		**[-1,+7]**		**[-1,+14]**		**[-1,+30]**	
	coeff	t-val	coeff	t-val	coeff	t-val	coeff	t-val	coeff	t-val
Panel I- Moody's										
Constant	**0.0031**	3.28	**0.0023**	5.3	**0.0042**	8.83	**0.0076**	23.52	**0.0156**	21.28
1n-up	-0.0009	-1.06	-0.0004	-0.32	0.0015	0.67	-0.0010	-0.31	-0.0045	-1.40
2n-up	-0.0019	-1.56	-0.0008	-0.52	-0.0013	-0.59	0.0011	0.53	-0.0076	-1.45
PO	-0.0011	-1.56	**-0.0020**	-1.69	-0.0021	-1.30	-0.0028	-1.45	-0.0042	-1.41
PW	0.0007	0.54	0.0007	0.38	-0.0025	-1.33	**-0.0050**	-2.02	-0.0002	-0.02
1n-dw	**0.0064**	2.45	0.0241	1.57	**0.0232**	1.97	**0.0433**	2.01	**0.0657**	1.76
2n-dw	**0.0114**	1.79	-0.0003	-0.08	0.0280	1.35	0.0500	1.53	**0.0514**	1.91
NO	0.0001	0.01	0.0024	0.90	0.0049	0.67	-0.0027	-0.36	-0.002	-0.16
NW	0.0026	1.49	0.0024	0.90	0.0018	0.51	-0.0042	-0.80	0.0072	0.64
Region dummies	Yes		Yes		Yes		Yes		Yes	
Year dummies	Yes		Yes		Yes		Yes		Yes	
Adjusted R^2	1.78%		0.22%		0.43%		0.83%		1.64%	
No. of obs.	205525		205414		205194		204809		203929	
Panel II - S&P										
Constant	**0.0013**	2.83	**0.0021**	4.49	**0.0039**	7.40	**0.0069**	11.32	**0.0141**	17.96
1n-up	-0.0014	-1.34	**-0.0021**	-1.94	-0.0015	-1.11	**-0.0036**	-2.03	**-0.0034**	-2.04
2n-up	0.0059	0.79	0.0045	0.58	0.0032	0.37	0.0048	0.56	0.0027	0.22
PO	0.0022	0.58	0.0023	0.58	0.0020	0.52	0.0010	0.24	0.0016	0.37
PW	-0.0106	-1.27	-0.0080	-1.21	-0.0078	-0.65	-0.0063	-0.34	-0.0088	-0.57
1n-dw	0.0051	1.21	0.0095	1.29	0.0065	0.92	0.0106	1.28	0.0091	0.85
2n-dw	-0.0110	-1.43	0.0157	1.17	-0.0108	-0.47	0.0390	0.86	0.0598	1.23
NO	**0.0032**	1.90	**0.0068**	2.35	**0.0097**	2.70	**0.0424**	2.02	0.0127	1.48
NW	0.0070	0.64	-0.0023	-0.17	0.0059	0.49	0.0022	0.15	0.0140	0.59
Region dummies	Yes		Yes		Yes		Yes		Yes	
Year dummies	Yes		Yes		Yes		Yes		Yes	
Adjusted R^2	0.16%		0.34%		0.75%		1.52%		2.98%	
No. of obs.	194586		194460		194208		193767		192759	
Panel III – Fitch										
Constant	**0.0012**	6.92	**0.0025**	10.40	**0.0049**	14.63	**0.0091**	19.25	**0.0193**	25.62
1n-up	-0.0008	-1.16	-0.0014	-1.60	**-0.0025**	-2.09	-0.0017	-0.97	-0.0015	-0.56
2n-up	-0.0015	-1.18	-0.0012	0.85	-0.0010	-0.41	-0.0017	-0.32	-0.0005	-0.07
PO	0.0008	0.75	0.0008	0.50	-0.0014	-0.91	0.0003	0.13	-0.0027	-0.85
PW	-0.0015	-1.34	-0.0017	0.88	-0.0081	-1.12	0.0081	0.70	0.0126	0.81
1n-dw	**0.0079**	1.69	**0.0134**	2.06	**0.0093**	1.66	0.0164	1.30	**0.0347**	1.77
2n-dw	**0.0272**	2.22	**0.0239**	1.87	**0.0934**	1.73	**0.1098**	1.73	0.0791	1.46
NO	-0.0005	-0.27	-0.0020	-0.76	0.0050	1.05	-0.0003	-0.04	-0.0063	-0.79
NW	0.0193	1.46	0.0200	1.29	0.0047	0.30	0.0199	0.74	0.0349	1.27
Region dummies	Yes		Yes		Yes		Yes		Yes	
Year dummies	Yes		Yes		Yes		Yes		Yes	
Adjusted R^2	0.09%		0.19%		0.58%		1.22%		2.76%	
No. of obs.	160803		160689		160461		160062		159150	

The table presents the coefficient estimates of Eq. (2) using sub-sample of sovereigns in emerging economies by each agency. The dependent variable is $\Delta \mathbf{EX_{i,s}}$, see Table 3 for definition. The independent variables are **1n-up**, **2n-up**, **PO**, **PW**, **1n-dw**, **2n-dw**, **NO**, **NW**, see Table 4 for definitions. Region dummies and year dummies are included. We apply Huber-White robust standard errors. The 'bold' coefficients are significant at the 10% level at least.

Table 6

Own-country exchange rate responses to sovereign credit signals – Developed Economies Eq. (2)

Event window	**[-1,+1]**		**[-1,+3]**		**[-1,+7]**		**[-1,+14]**		**[-1,+30]**	
	coeff	t-val	coeff	t-val	coeff	t-val	coeff	t-val	coeff	t-val
Panel I- Moody's										
Constant	**-0.0003**	-2.77	**-0.0006**	-3.91	**-0.0012**	-5.44	**-0.0022**	-7.03	**-0.0037**	-7.90
1n-up	0.0004	0.49	-0.0017	-1.46	0.0006	0.35	0.0002	0.10	-0.0019	-0.53
2n-up	**-0.0017**	-2.68	**-0.0014**	-1.80	-0.0013	-0.79	-0.0045	-1.47	-0.0014	-0.40
PO	-0.0004	-0.30	-0.0017	-1.54	0.0003	0.22	0.0012	0.51	0.0031	0.47
PW	0.0003	0.47	0.0012	-0.83	0.0002	0.08	0.0008	0.30	-0.0070	-1.41
1n-dw	0.0169	0.95	0.0093	0.67	0.0049	0.56	0.0045	0.29	0.0167	1.08
2n-dw	0.0004	0.01	-0.0207	-0.64	-0.0043	-0.11	0.0386	0.82	0.0864	1.21
NO	0.0125	1.34	0.0159	1.37	0.0186	1.40	0.0148	1.16	0.0196	1.23
NW	0.0064	0.89	0.0115	1.30	**0.0159**	1.74	**0.018**	1.67	0.0370	1.50
Region dummies	Yes		Yes		Yes		Yes		Yes	
Year dummies	Yes		Yes		Yes		Yes		Yes	
Adjusted R^2	0.22%		0.42%		0.91%		1.87%		4.03%	
No. of obs.	130792		130700		130516		130194		129458	
Panel II - S&P										
Constant	**-0.0003**	-2.66	**-0.0006**	-3.83	**-0.0012**	-5.38	**-0.0022**	-7.00	**-0.0037**	-7.96
1n-up	-0.0010	-0.85	-0.0005	-0.26	-0.0007	-0.30	-0.0021	-0.51	-0.0020	-0.44
2n-up	-0.0041	-1.00	-0.0054	-0.89	-0.0101	-0.87	-0.0160	-0.84	-0.0608	-0.99
PO	-0.0008	-0.52	-0.0002	-0.08	0.0021	0.89	0.0030	0.87	0.0010	0.27
PW	-0.0016	-0.38	-0.0034	-0.57	-0.0092	-0.79	-0.0189	-0.99	-0.0594	-0.97
1n-dw	0.0055	1.43	0.0043	0.72	0.0002	0.05	0.0063	0.68	0.0106	0.70
2n-dw	0.0493	1.48	0.0076	0.22	**0.0359**	2.32	**0.1142**	2.52	**0.1262**	1.82
NO	-0.0011	-0.43	-0.0002	-0.05	0.0031	0.76	0.0006	0.10	-0.0010	-0.12
NW	**0.0258**	2.65	**0.0253**	1.90	**0.0223**	1.78	**0.0365**	2.30	**0.0503**	2.17
Region dummies	Yes		Yes		Yes		Yes		Yes	
Year dummies	Yes		Yes		Yes		Yes		Yes	
Adjusted R^2	0.35%		0.46%		0.99%		2.06%		4.34%	
No. of obs.	120722		120632		120452		120137		119417	
Panel III – Fitch										
Constant	**-0.0003**	-2.01	**-0.0007**	-2.84	**-0.0013**	-4.05	**-0.0024**	-5.26	**-0.0036**	-5.33
1n-up	**-0.0020**	-1.74	**-0.0050**	-3.00	-0.0033	-1.15	-0.0029	-1.01	**-0.0078**	-1.66
2n-up	**-0.0063**	-1.73	-0.0006	-0.38	0.0088	0.73	0.0160	0.68	-0.0070	-0.43
PO	-0.0001	-0.03	0.0002	0.07	-0.0021	-0.67	-0.0027	-0.73	-0.0052	-0.67
PW	**-0.0121**	1.76	-0.0011	-0.26	-0.0068	-0.60	-0.0050	-0.41	-0.0135	-0.85
1n-dw	**0.0051**	1.68	0.0033	0.64	0.0114	1.18	0.0200	0.91	0.0400	0.98
2n-dw	**0.0302**	1.85	-0.0189	-0.66	0.0278	1.39	**0.0499**	2.08	**0.1143**	2.13
NO	0.0025	0.59	0.0063	1.16	0.0021	0.26	-0.0016	-0.15	-0.0105	-0.74
NW	0.0109	1.44	-0.0093	-0.99	-0.0002	-0.02	-0.0081	-0.61	-0.0242	-0.91
Region dummies	Yes		Yes		Yes		Yes		Yes	
Year dummies	Yes		Yes		Yes		Yes		Yes	
Adjusted R^2	0.09%		0.55%		1.10%		2.22%		4.73%	
No. of obs.	106410		106330		106170		105890		105250	

The table presents the coefficient estimates of Eq. (2) using sub-sample of sovereigns in developed economies by each agency. The dependent variable is $\Delta \mathbf{EX}_{i,s}$, see Table 3 for definition. The independent variables are **1n-up**, **2n-up**, **PO**, **PW**, **1n-dw**, **2n-dw**, **NO**, **NW**, see Table 4 for definitions. Region dummies and year dummies are included. We apply Huber-White robust standard errors. The 'bold' coefficients are significant at the 10% level at least.

Table 7 – Spillover effect in 'EU-CA' region

	Positive								Negative							
Event window	**[-1,+1]**		**[-1,+3]**		**[-1,+7]**		**[-1,+14]**		**[-1,+1]**		**[-1,+3]**		**[-1,+7]**		**[-1,+14]**	
	Coeff	t-val	coeff	t-val	coeff	t-val	coeff	t-val	coeff	t-val	coeff	t-val	coeff	t-val	coeff	t-val
Panel I – Moody's																
Constant	**-0.1169**	-2.15	**-0.0248**	-4.73	**-0.0189**	-2.89	**-0.0215**	-1.81	**-0.0092**	-1.71	**-0.02**	-3.89	**-0.0135**	-2.06	**-0.0193**	-1.65
$\Delta LCCR_i$	**-0.0022**	-4.38	**-0.0034**	-4.73	**-0.0022**	-2.36	**-0.0103**	-7.55	**0.0018**	2.28	**0.0042**	3.81	**0.006**	3.33	**0.0051**	1.94
CCR (event co.)	**-0.0001**	-2.52	-0.0001	-0.09	0.0001	0.40	0.00001	0.01	**-0.0002**	-3.86	**-0.0001**	-2.02	-0.0001	-0.99	-0.0001	-0.30
CCR (non-event co.)	**0.0002**	1.96	-0.0002	1.26	-0.0001	-0.46	-0.0001	-0.69	**0.0002**	1.96	0.0002	1.25	-0.0001	-0.48	-0.0001	-0.65
Event country D	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
non-event country D	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Year dummies	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Adjusted R^2	9.06%		8.95%		9.47%		11.79%		8.93%		8.92%		9.61%		11.37%	
Panel II – S&P																
Constant	0.0105	1.18	**0.0124**	1.89	0.0061	0.56	**0.0620**	4.85	-0.0109	-1.20	0.0096	1.48	-0.0076	-0.65	**0.0552**	4.39
$\Delta LCCR_i$	**-0.0012**	-1.73	-0.0006	-0.78	**-0.0022**	-2.01	**-0.0100**	-6.85	**0.0141**	8.31	**0.0086**	4.15	**0.0090**	3.11	**0.0216**	5.47
CCR (event co.)	**-0.0003**	-6.31	**-0.0003**	-4.43	**-0.0005**	-5.90	**-0.0004**	-2.91	**-0.0001**	-1.71	**-0.00014**	-2.05	**-0.0003**	-3.75	-0.0003	-0.22
CCR (non-event co.)	-0.0001	-0.75	-0.0001	-0.45	-0.0002	-1.28	**-0.0004**	-2.2	-0.0001	-0.72	-0.0001	-0.44	-0.0002	-1.27	**-0.0004**	-2.18
Event country D	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
non-event country D	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Year dummies	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Adjusted R^2	7.70%		6.98%		11.41%		12.53%		8.89%		7.24%		11.54%		12.72%	
Panel C – Fitch																
Constant	0.005	1.17	0.0075	1.58	**0.0187**	2.55	**0.0470**	5.22	0.0090	0.92	0.0059	1.24	**0.0132**	1.85	**0.0443**	4.93
$\Delta LCCR_i$	-0.0006	-1.05	-0.0013	-1.36	-0.0009	-0.60	-0.0007	-0.40	**0.0029**	3.62	**0.0040**	3.63	**0.0142**	8.77	**0.0069**	3.52
CCR (event co.)	-0.00001	-0.04	0.0001	1.43	**-0.0001**	-1.65	**-0.0004**	-5.83	0.00003	0.63	**-0.0001**	-1.96	0.00004	0.64	**-0.0004**	-5.04
CCR (non-event co.)	**-0.0001**	-2.05	-0.0001	-1.46	**-0.0003**	-3.53	**-0.0007**	-5.54	**-0.0001**	-2.03	-0.0001	-1.42	**-0.0003**	-3.46	**-0.0007**	-5.51
Event country D	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
non-event country D	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Year dummies	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Adjusted R^2	11.70%		12.69%		19.91%		22.11%		11.85%		12.83%		20.96%		22.24%	

The table presents the coefficient estimates of Eq. (3) using a sample credit sovereign events only (see Table 2) in Europe and Central Asia (EU-CA) region by each agency. $\Delta\mathbf{EX_{j,s}}$**:** change in the natural logarithm of the US$ exchange rate of non-event country *j* in the specified time windows. $\Delta\mathbf{LCCR_{it}}$**:** 1-day change in the logit-type transformation of the 58-point sovereign rating scale of event country *i* at event date *t*. We examine negative and positive signals separately. CCR: the level of event and non event country comprehensive credit rating. Year, event country and non-event country dummies are included. We apply Huber-White robust standard errors. The 'bold' coefficients are significant at the 10% level at least.

Table 8 – Spillover effect in 'LA' region

	Positive								Negative							
Event window	**[-1,+1]**		**[-1,+3]**		**[-1,+7]**		**[-1,+14]**		**[-1,+1]**		**[-1,+3]**		**[-1,+7]**		**[-1,+14]**	
	Coeff	t-val	coeff	t-val	coeff	t-val	coeff	t-val	coeff	t-val	coeff	t-val	Coeff	t-val	coeff	t-val
Panel I – Moody's																
Constant	0.0051	1.22	-0.0002	-0.05	0.0016	0.27	**0.0144**	1.88	0.0043	1.04	-0.0003	-0.06	0.0003	0.05	**0.0137**	1.76
$\Delta LCCR_i$	0.00002	0.03	-0.0013	-1.01	-0.0004	-0.4	-0.0017	-1.13	0.0012	1.08	0.0005	0.38	0.0016	1.11	0.0013	0.70
CCR (event co.)	**-0.0002**	-2.59	**-0.0001**	-2.44	-0.0001	-0.73	**-0.0002**	-2.29	**-0.0001**	-2.62	**-0.0001**	-2.25	-0.0001	-0.22	**-0.0002**	-1.73
CCR (non-event co.)	-0.0005	-0.85	0.0001	1.09	0.0001	0.6	-0.0008	-0.49	-0.0001	-0.85	0.0001	1.10	0.0001	0.61	-0.0001	-0.49
Event country D	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
non-event country D	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Year dummies	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Adjusted R^2	2.36%		2.21%		2.42%		4.17%		2.38%		2.18%		2.44%		4.44%	
Panel II – S&P																
Constant	0.0015	0.41	-0.0007	-0.17	0.0032	0.72	-0.0071	-0.84	-0.0041	-0.82	-0.0060	-1.01	-0.0003	-0.04	-0.0044	-0.49
$\Delta LCCR_i$	-0.0001	-0.28	-0.0003	-0.69	-0.0001	-0.06	-0.0006	-0.89	0.0012	1.19	0.0014	1.14	0.0015	1.12	0.0022	1.31
CCR (event co.)	0.0001	1.18	0.0001	1.22	0.0002	1.33	0.0001	0.82	0.0002	1.35	0.0002	1.41	0.0002	1.54	0.0002	1.19
CCR (non-event co.)	-0.002	-1.46	-0.0003	-1.59	**-0.0004**	-1.97	-0.0001	-0.20	-0.0002	-1.45	-0.0003	-1.58	**-0.0004**	-1.96	-0.0001	-0.19
Event country D	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
non-event country D	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Year dummies	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Adjusted R^2	1.70%		1.98%		3.67%		4.17%		1.75%		2.01%		3.70%		4.05%	
Panel C – Fitch																
Constant	-0.0012	-0.23	-0.0024	-0.43	-0.0073	-0.93	0.0045	0.47	-0.0046	-0.76	-0.0038	-0.60	-0.0070	-0.73	**0.0133**	1.14
$\Delta LCCR_i$	-0.0004	-0.95	-0.0004	-0.71	**-0.0013**	-1.69	**-0.0021**	-2.04	0.0005	0.46	-0.0001	-0.12	-0.0003	-0.11	**0.0053**	1.72
CCR (event co.)	0.0001	1.09	0.0001	1.18	0.0002	1.23	0.0002	0.89	0.0001	0.01	0.0001	0.79	0.0002	0.76	-0.0001	-0.43
CCR (non-event co.)	**-0.0002**	-1.84	0.0001	0.4	0.00001	0.01	-0.0003	-1.12	**-0.0002**	-1.85	0.0001	0.39	-0.00001	-0.02	-0.0003	-1.18
Event country D	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
non-event country D	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Year dummies	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Adjusted R^2	4.93%		4.39%		6.58%		8.83%		4.93%		4.39%		6.53%		8.89%	

The table presents the coefficient estimates of Eq. (3) using a sample credit sovereign events only (see Table 2) in Latina America (LA) region by each agency. $\Delta\mathbf{EX_{j,s}}$**:** change in the natural logarithm of the US$ exchange rate of non-event country *j* in the specified time windows. $\Delta\mathbf{LCCR}_{it}$: 1-day change in the logit-type transformation of the 58-point sovereign rating scale of event country *i* at event date *t*. We examine negative and positive signals separately. CCR: the level of event and non event country comprehensive credit rating. Year, event country and non-event country dummies are included. We apply Huber-White robust standard errors. The 'bold' coefficients are significant at the 10% level at least.

Table 9 – Spillover effect in 'E S Asia' region

	Positive								Negative							
Event window	**[-1,+1]**		**[-1,+3]**		**[-1,+7]**		**[-1,+14]**		**[-1,+1]**		**[-1,+3]**		**[-1,+7]**		**[-1,+14]**	
	Coeff	t-val	coeff	t-val	coeff	t-val	coeff	t-val	coeff	t-val	coeff	t-val	coeff	t-val	coeff	t-val
Panel I – Moody's																
Constant	-0.0043	-0.72	-0.0010	-0.17	-0.0056	-0.69	0.0018	0.15	0.0041	0.69	0.0039	0.68	-0.0100	-1.2	0.0006	0.05
$\Delta LCCR_i$	0.0011	1.21	**-0.0033**	-2.06	**-0.0037**	-1.73	0.0021	0.57	0.0001	0.09	**0.0081**	2.20	**0.0126**	3.09	0.0031	0.58
CCR (event co.)	-0.0002	-1.48	**-0.0004**	-1.94	0.00003	0.11	**-0.0012**	-2.07	-0.0002	-1.36	-0.0003	-1.21	0.0003	1.02	**-0.0011**	-1.83
CCR (non-event co.)	0.0001	0.22	**0.0005**	1.96	0.0004	1.41	**0.0015**	2.82	0.0004	0.22	**0.0004**	1.90	0.0004	1.34	**0.0014**	2.80
Event country D	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
non-event country D	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Year dummies	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Adjusted R^2	6.53%		12.59%		11.56%		18.90%		6.50%		13.20%		12.33%		18.91%	
Panel II – S&P																
Constant	-0.0008	-0.23	0.0070	0.67	-0.0009	-0.08	0.0013	0.11	-0.0005	-0.14	0.0087	0.78	0.0004	0.03	0.0193	1.12
$\Delta LCCR_i$	-0.0003	0.71	-0.0003	-0.29	-0.0012	-0.88	-0.0001	-0.08	-0.0007	-0.92	**0.0036**	1.76	0.0028	1.26	0.0022	0.78
CCR (event co.)	**-0.0002**	-2.73	**-0.0003**	-2.21	0.0002	1.43	-0.0004	-1.20	**-0.0002**	-2.87	**-0.0004**	-2.62	0.0002	0.83	-0.0005	-1.35
CCR (non-event co.)	**0.0002**	1.66	-0.00004	-0.08	0.0001	0.22	0.0004	0.78	**0.0002**	1.66	-0.0001	-0.10	0.0001	0.20	0.0004	0.76
Event country D	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
non-event country D	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Year dummies	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Adjusted R^2	5.36%		3.53%		3.64%		7.95%		5.37%		3.60%		3.67%		7.96%	
Panel C – Fitch																
Constant	**0.0715**	2.30	0.0492	1.57	0.0476	1.35	0.0239	0.34	**0.0859**	2.10	0.0682	1.44	0.0201	0.74	0.0012	0.02
$\Delta LCCR_i$	0.0011	0.13	0.0014	0.14	-0.0253	-1.18	-0.0042	-0.40	0.0133	0.33	0.0176	1.12	-0.0005	-0.50	0.0182	0.69
CCR (event co.)	-0.0007	-1.36	-0.0007	-1.13	-0.0002	-1.09	-0.0005	-0.43	-0.0009	-1.56	-0.0009	-1.30	-0.0003	-1.02	-0.0003	-0.30
CCR (non-event co.)	-0.0003	-0.71	0.0002	0.56	**0.0010**	2.68	**0.0014**	2.26	-0.0003	-0.76	0.0002	0.46	-0.0006	-0.13	**0.0014**	2.28
Event country D	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
non-event country D	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Year dummies	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Adjusted R^2	12.52%		8.88%		13.07%		18.22%		13.50%		10.03%		11.39%		10.58%	

The table presents the coefficient estimates of Eq. (3) using a sample credit sovereign events only (see Table 2) in East Asia & Pacific and South Asia (E S Asia) region by each agency. $\Delta\mathbf{EX}_{j,s}$**:** change in the natural logarithm of the US$ exchange rate of non-event country *j* in the specified time windows. $\Delta\mathbf{LCCR}_{it}$: 1-day change in the logit-type transformation of the 58-point sovereign rating scale of event country *i* at event date *t*. We examine negative and positive signals separately. CCR: the level of event and non event country comprehensive credit rating. Year, event country and non-event country dummies are included. We apply Huber-White robust standard errors. The 'bold' coefficients are significant at the 10% level at least.

Table 10 – Spillover effect in 'ME-Af' region

	Positive								Negative							
Event window	**[-1,+1]**		**[-1,+3]**		**[-1,+7]**		**[-1,+14]**		**[-1,+1]**		**[-1,+3]**		**[-1,+7]**		**[-1,+14]**	
	Coeff	t-val	coeff	t-val	coeff	t-val	coeff	t-val	coeff	t-val	coeff	t-val	coeff	t-val	coeff	t-val
Panel I – Moody's																
Constant	-0.0005	-1.10	0.0067	0.74	0.0085	0.65	0.0227	1.3	-0.0003	-0.05	0.0061	0.68	0.0097	0.75	0.0219	1.27
$\Delta LCCR_i$	-0.0026	-1.09	0.0012	0.29	0.0094	1.45	0.0001	0.01	0.0014	0.29	0.0073	0.86	0.0086	0.87	0.0105	0.76
CCR (event co.)	0.0004	0.45	-0.0002	-1.16	-0.0002	-0.37	-0.0004	-1.22	0.0001	0.21	-0.0001	-1.01	-0.0003	-1.17	-0.0004	-1.21
CCR (non-event co.)	-0.00001	-0.33	0.00002	0.24	0.0001	0.75	**0.0003**	1.90	-0.0002	-0.35	0.00001	0.20	0.0001	0.72	**0.0003**	1.85
Event country D	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
non-event country D	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Year dummies	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Adjusted R^2	10.22%		13.37%		11.54%		11.84%		10.11%		13.48%		11.36%		11.91%	
Panel II – S&P																
Constant	-0.0032	-0.42	**0.0160**	1.88	**0.0186**	1.92	0.0046	0.29	-0.0091	-0.98	0.0061	0.58	0.0144	1.22	0.00	0.24
$\Delta LCCR_i$	-0.0085	-1.11	-0.0072	-0.84	-0.0003	-0.03	-0.0022	0.20	0.0025	1.30	**0.0049**	1.93	0.0024	0.81	0.0001	0.02
CCR (event co.)	0.0002	0.87	-0.0001	-0.33	-0.0002	-0.55	-0.0005	0.99	0.0003	1.11	0.0004	0.15	-0.0001	-0.27	0.0005	1.06
CCR (non-event co.)	-0.0007	-0.83	-0.0008	-0.87	-0.0006	-0.68	-0.0012	-1.02	-0.0007	-0.82	-0.0008	-0.86	-0.0006	-0.68	-0.0012	-1.02
Event country D	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
non-event country D	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Year dummies	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Adjusted R^2	9.38%		9.12%		9.58%		12.63%		9.26%		9.13%		9.60%		12.62%	
Panel C – Fitch																
Constant	**0.0238**	2.62	0.0062	0.62	0.0136	1.16	-0.0251	-1.38	**0.0183**	1.65	-0.0005	-0.04	0.0077	0.56	-0.0300	-1.58
$\Delta LCCR_i$	0.0269	0.81	0.026	0.79	0.0343	1.03	0.0247	0.73	0.0226	1.54	**0.0274**	1.83	0.0245	1.52	0.0182	0.94
CCR (event co.)	-0.0003	-0.92	**-0.0008**	-2.02	**-0.0008**	-1.99	**-0.0015**	-2.89	-0.0007	-1.06	**-0.0012**	-1.71	**-0.0013**	-1.81	**-0.0019**	-2.33
CCR (non-event co.)	-0.0003	-0.72	-0.0004	-0.82	-0.0004	-0.92	-0.0003	-0.59	-0.0003	-0.70	-0.0003	-0.75	-0.0004	-0.85	-0.0003	-0.53
Event country D	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
non-event country D	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Year dummies	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Adjusted R^2	5.08%		6.06%		7.07%		8.36%		5.76%		5.99%		6.88%		8.27%	

The table presents the coefficient estimates of Eq. (3) using a sample credit sovereign events only (see Table 2) in Middle East and North Africa and Sub-Saharan Africa (ME - Af) region by each agency. $\Delta \mathbf{EX_{j,s}}$**:** change in the natural logarithm of the US$ exchange rate of non-event country *j* in the specified time windows. $\Delta \mathbf{LCCR_{it}}$: 1-day change in the logit-type transformation of the 58-point sovereign rating scale of event country *i* at event date *t*. We examine negative and positive signals separately. CCR: the level of event and non event country comprehensive credit rating. Year, event country and non-event country dummies are included. We apply Huber-White robust standard errors. The 'bold' coefficients are significant at the 10% level at least.

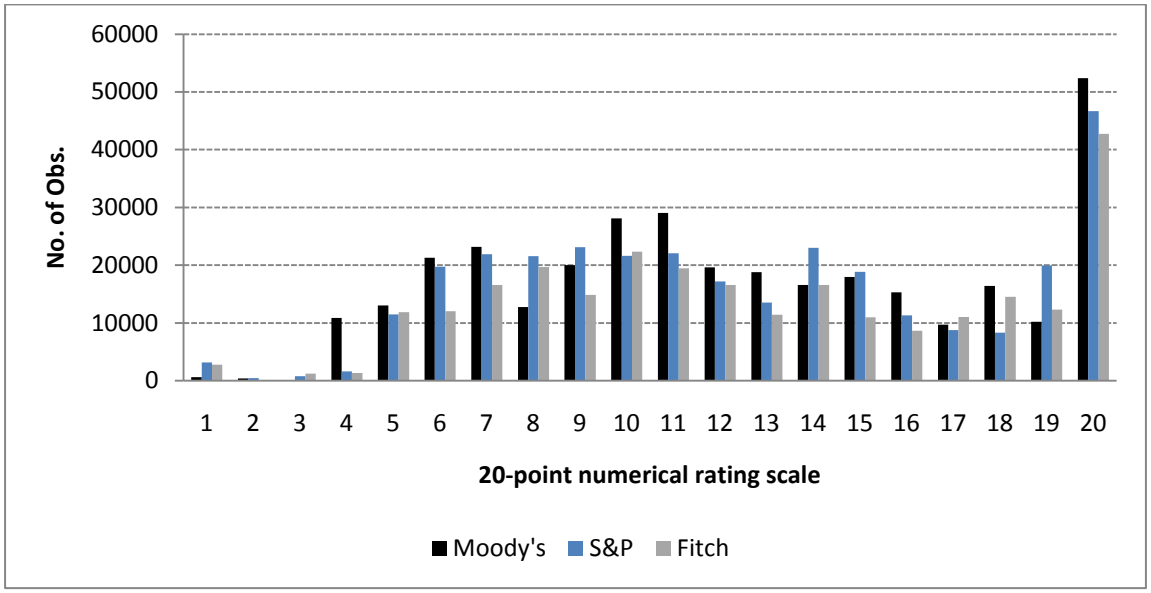

Fig. 1. Distribution of daily 20-point numerical ratings of sovereign issuers. The time period is 10 August 1994 to 31 July 2010 for Moody's, S&P and Fitch. The credit ratings scale is transformed into a 20-point numerical scale (Aaa/AAA =20, Aa1/AA+ =19…Caa3/CCC- =2, Ca/CC, C/SD-D =1).

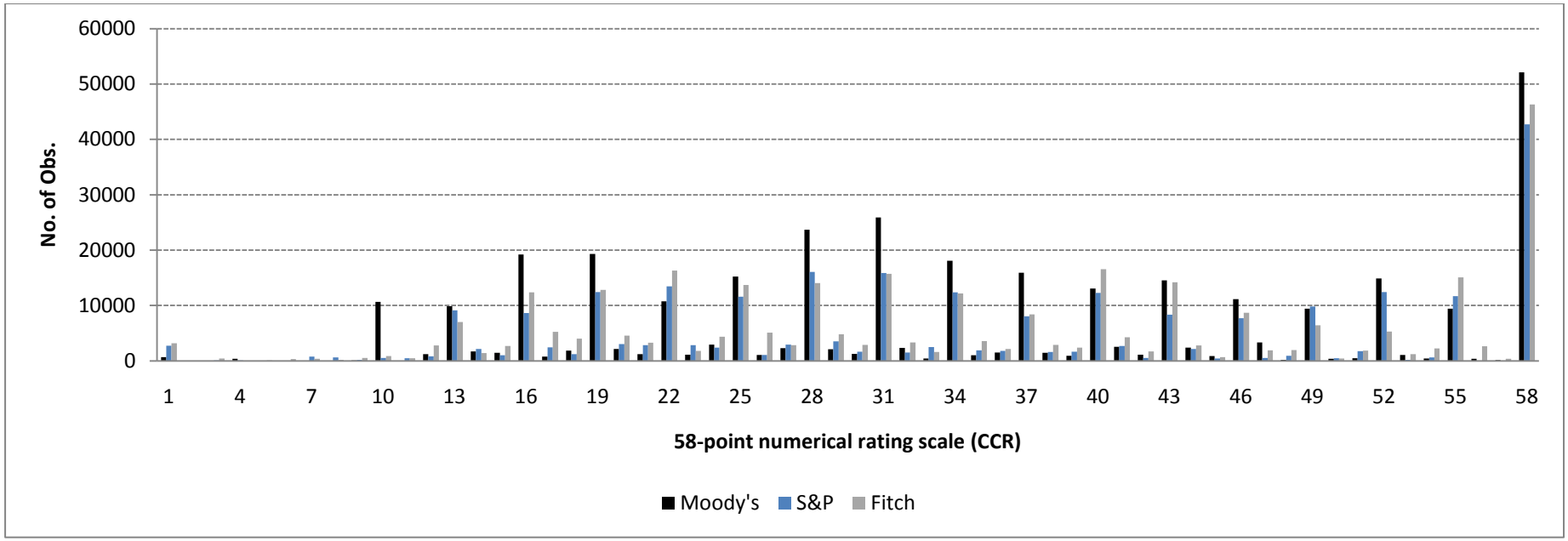

Fig. 2. Distribution of daily 58-point numerical ratings of sovereign issuers. The time period is 10 August 1994 to 31 July 2010 for Moody's, S&P and Fitch. The credit ratings scale is transformed into a 58-point numerical scale (Aaa/AAA =58, Aa1/AA+ =55, Aa2/AA = 52 …Caa3/CCC- =4, Ca/CC, C/SD-D = 1), and we added '+2' for positive watch, '+1' for positive outlook, '-1' for negative outlook, '-2' for negative watch, and '0' for stable outlook and no watch/outlook assignments.