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Rating agencies' signals during the European sovereign debt crisis: Market impact and spillovers

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ABSTRACT

The ongoing financial crisis has drawn considerable attention to the role of credit rating agencies in the financial system. We examine how the foreign exchange market reacts to sovereign credit events prior to (2000–2006) and during the crisis (2006–2010). The sample includes a broad set of countries in Europe and Central Asia in order to investigate spillover effects. We find that rating agencies' signals do affect the own-country exchange rate and we identify strong spillover effects to other countries' exchange rates in the region. In both cases, the impact of outlook and watch signals is stronger than the impact of actual rating changes. Market reactions and spillovers are far stronger during the financial crisis period than pre-crisis. Negative news from all three major agencies has an impact, whereas only Moody's positive news produces a reaction. Negative news from Fitch tends to have the strongest effect. The findings are important in enhancing understanding of the role of rating agencies and the market response to their signals.

1. Introduction

The European sovereign debt crisis brought increased attention to the role of credit rating agencies (CRAs) and the interdependence between financial markets during crises. IMF (2010a) stated that sovereign default was the most pressing risk facing the global economy. Many sovereign ratings, particularly for Greece, Ireland, and Portugal, became under persistent downgrade pressure, as a result of increased government deficits and debt levels, and weak economic growth. Sovereign bond and credit default swap spreads widened, and stock markets were deflated, not only in the worst-affected countries, as market concerns spread to other indebted states in the euro-zone and to the USA. The crisis was also accompanied by exchange rate volatility, including the US$ versus the Euro.

CRAs were accused of contributing to the US subprime crisis by being too lax in rating some structured finance products. There is an ongoing debate on revenue versus reputation issues (e.g. Mathis et al., 2009). In contrast, the criticism of CRAs during the European sovereign debt crisis has been more focused on the extent and timing of downgrades. The role of CRAs has expanded significantly during the last 20 years, whereby credit ratings are now heavily hardwired into investment processes, financial contracts and regulatory frameworks. Hence, CRA news releases have potentially systemic consequences (Bank of England, 2011) and recent regulatory changes have sought to reduce this effect.

The uses of ratings imply that CRAs must manage a tension between the stability of their ratings and their short-term 'accuracy' (e.g. Löffler, 2005). To mitigate the stability-accuracy tension, credit outlook and watch are supplemental

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instruments used by CRAs to signal adjustments in their opinion of issuer credit quality.[1] These instruments perform an important economic function (e.g. Boot et al., 2006; Bannier and Hirsch, 2010). Each CRA has a clear reputational goal of providing timely and high quality credit signals to financial markets. Prior studies show that outlook and watch signals are at least as important as rating changes in their market impact (e.g. Kaminsky and Schmukler, 2002; Sy, 2004; Hill and Faff, 2010; Afonso, 2011). The IMF (2010b) stresses that CRAs influence stock and bond prices, not only by revealing new information but also through a 'certification' role, though this is most evident via their use of outlook and watch signals rather than rating changes. Kim and Wu (2011) provide evidence that improvements in sovereign credit quality help to encourage international bank flows from developed to emerging economies, but they point out that outlook and watch events are associated with much stronger economic effects than are rating changes. Such evidence is not surprising given that rating changes are partially anticipated in some cases since market participants are aware of the prior outlook/watch status.

Sovereign ratings represent a ceiling for the ratings assigned to non-sovereign issuers within the country.[2] This was particularly problematic for several Greek, Irish and Portuguese banks, since their ratings were downgraded to speculative status. In addition, sovereign ratings contribute to the smooth and efficient working of the global sovereign debt market (House of Lords, 2011). They also have a direct impact on a sovereign's cost of borrowing, and this is central to the question of whether CRA actions contributed to a worsening of the European sovereign debt crisis.

This paper firstly documents the extent of sovereign rating news from Moody's Investors Service, Standard and Poor's (S&P) and Fitch during the European sovereign debt crisis. The analysis then proceeds to examine how the foreign exchange spot market reacts to sovereign credit events in the Europe and Central Asia (EU–CA) region prior to, and during this crisis. We also investigate spillover effects, i.e. the impact of a given sovereign credit signal on other countries' exchange rates, which is a key contribution of this study. To the best of our knowledge, this paper is the first to provide evidence on how sovereign credit news affected the foreign exchange market during and immediately prior to the current financial crisis (see Section 2).

We aim to identify whether sovereign credit signals released by a particular CRA have a stronger influence on the market during the crisis than the signals of other CRAs. We also add to the literature by analysing whether any influence on the market is related to a specific type of credit signal (positive versus negative events, and actual rating changes versus outlook actions versus watch signals). Prior related research has mainly centred on actual rating changes (see Section 2). We also 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).

The main findings are summarised as follows. The local and spillover effects of sovereign credit news on foreign exchange markets in the 'EU–CA' region are stronger during the crisis period. The effect of negative sovereign credit events are most marked for higher-rated countries during the crisis period, while the impact is most marked for lower-rated countries in the pre-crisis period. During the crisis period, negative news from the three CRAs affects the own-country exchange rates and contributes to contagion. Also, positive news from Moody's affects the home currency and those of other countries. Fitch signals induce the strongest reactions during the crisis period. We also find a unique market reaction to S&P in the case of negative outlook signals during the crisis period. Overall, watch and outlook signals have much more impact than rating changes on the foreign exchange market.

The rest of the paper is organised as follows. Section 2 briefly reviews the literature on the market impact of sovereign ratings. Section 3 discusses the effect of the 2007–2011 financial crisis on European economies and on CRAs. Section 4 describes the data set of sovereign credit events and foreign exchange rates. Section 5 presents the methodology used to examine the effects of sovereign credit news. Section 6 discusses the empirical results, and Section 7 concludes the paper.

2. The market impact of sovereign rating signals

Prior literature demonstrates that sovereign rating news does affect financial markets. Negative rating events impact own-country equity and bond markets and cause significant spillovers to other countries' equity and bond markets, while upgrades have limited or insignificant impact (e.g. Kaminsky and Schmukler, 2002; Brooks et al., 2004; Sy, 2004; Gande and Parsley, 2005; Ferreira and Gama, 2007; Hooper et al., 2008; Hill and Faff, 2010; Afonso, 2011). Negative credit announcements are typically more informative than positive ones, given the stronger negative reputational effects for an agency being tardy in the case of downgrades (Alsakka and ap Gwilym, 2010). Issuers may have no incentive to leak negative news prior to a downgrade, while they do so for positive news prior to an upgrade. Goldstein et al. (2000) and Sy (2004) examine whether sovereign ratings anticipate currency crises, and find that sovereign ratings help predict the probability of distressed debt events, but they fail to predict currency 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 crises.

[1] Outlooks reflect a CRA's medium-term (1–2 years) view on the development of a credit rating, while watchlists are stronger indications focused on a typical ex-ante target horizon of 3 months.

[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).

Most previous market impact studies use data from a single agency only (usually Moody's or S&P) or pool data from different agencies.[3] However, other research demonstrates a potential for unequal reactions to sovereign credit signals across agencies (e.g. Brooks et al., 2004; Alsakka and ap Gwilym, 2010; Hill and Faff, 2010; Afonso, 2011). Therefore, pooling ratings data from different agencies together (as done by e.g. Kaminsky and Schmukler, 2002; Sy, 2004; Hooper et al., 2008) may produce misleading results. By considering the three main CRAs separately, we contribute to the current debate on the level of competition in this industry.

The fact that markets react to sovereign credit signals implies that CRAs possess private information, not previously priced in the market. Surprisingly, there is only scant evidence on links between sovereign credit news and the foreign exchange market, despite its huge levels of daily turnover (see BIS, 2010). Brooks et al. (2004) and Hooper et al. (2008) study stock market reactions to CRA signals, but offer some indirect evidence on the foreign exchange market reaction. In particular, Hooper et al. (2008) shows that such reactions tend to be concentrated in crisis periods (during 1995–2003).[4]

Arezki et al. (2011) examine the spillover effects of sovereign rating news on CDS spreads and stock market indices for selected European countries during 2007–2010. They find that rating downgrades lead to significant spillovers across countries. For example, while the Austrian sovereign rating remained unchanged, Austrian CDS spreads and stock market index moved sharply following the downgrades of Baltic countries, mainly driven by the exposures of Austrian banks. Afonso (2011) finds evidence of significant spillover effects of sovereign rating news from the three major CRAs (pooled together) for bond markets for 24 European countries during 1995–2010.

Prior empirical studies also suggest that exchange rate behaviour affects stock markets (e.g. Phylaktis and Ravazzolo, 2005). Therefore, the stock market reactions could be triggered by the exchange rate movements following sovereign credit signals. Additionally, a sovereign credit signal has implications for the future relative economic status of a country, which naturally influences the relative currency value. Empirical findings suggest that currency depreciation is positively related to increased default risk (see Ahumada and Garegnani, 2005; Hui and Chung, 2011; Kasimati, 2011). Therefore, we expect that sovereign credit signals will significantly impact the country's exchange rate and spillover into other countries' exchange rates. The hypotheses formulated based on the prior literature are stated at the start of Section 5 and linked to the empirical methodology.

3. The effect of the 2007–2011 financial crisis on European economies and on CRAs

3.1. European sovereigns and banks

This financial crisis was by no means restricted to the banking sector. After the collapse of Lehman Brothers in September 2008, many governments in the euro area and elsewhere committed large resources to guarantee and rescue financial institutions (Gerlach et al., 2010). This led to increasing public debt and thereby higher risk of sovereign default. Mody (2009) finds that governments' exposures to financial sector weakness became more prominent as the crisis progressed. Investors perceived this as a credit risk transfer from the banking sector to governments, and thereby sovereign debt spreads widened while risk spreads of financial institutions narrowed (Ejsing and Lemke, 2011). For example, sovereign spreads for Ireland started to increase after the government extended a guarantee to the banking system (Sgherri and Zoli, 2009). The cost of insuring against sovereign risk, as implied by credit default swap (CDS) premia, substantially increased for most European countries. For example, the senior 5-year CDS premia on debt issued by the UK, US, France, Germany, Greece and Spain increased from 9, 8, 10, 7, 22 and 18 basis points in January 2008 to 93, 43, 95, 50, 762 and 269 basis points in June 2010, respectively (Bank of England, 2010). Therefore, important links between financial sector distress and public sector bailouts were created (Sgherri and Zoli, 2009; Gerlach et al., 2010).

IMF (2011) emphasises the close interconnection between financial institutions and sovereigns during the financial crisis, with spillovers occurring in both directions. Sovereign debt concerns raised doubts about the strength of some European banks, including those in France, Germany and the UK. Blundell-Wignall and Slovik (2010) find that banks are heavily exposed to the sovereign debt of their own country. For example, the exposure of Greek banks to Greek sovereign debt represented 226% of their Tier 1 capital, while in Italy, Hungary and Spain, the equivalent figures were 157%, 133% and 113%, respectively. Globally, banks faced a tough refinancing challenge, with at least US$5 trillion of medium to long-term funding maturing between 2010 and 2013 (Bank of England, 2010).

There are many potential channels through which sovereign credit news may spillover across countries due to the globalised nature of modern financial markets. Ferreira and Gama (2007) and Sy (2009) provide in-depth analysis of such channels, including rating-based triggers, arising in banking regulation, investment mandates (see Cantor et al., 2007) and European Central Bank (ECB) collateral rules. One main channel through which sovereign risk may spillover to financial sectors across countries is where domestic banks hold foreign sovereign debt (Arezki et al., 2011). An increase in a given sovereign's risk will likely affect the stability and profitability of banks in other countries holding this debt, and this was

[3] There is little analysis of the information content of Fitch sovereign actions. Brooks et al. (2004) and Hill and Faff (2010) examine stock market reactions to actual rating changes by Moody's, S&P and Fitch separately (for the period 1973–2001 and 1990–2006 respectively).

[4] These crises were in Asia, Latin America, Russia and Turkey. Also, for a set of emerging markets, Cavallo et al. (2008) report evidence of the effect on CRA news on exchange rates.

the case in Europe during 2007–2011. For example, Blundell-Wignall and Slovik (2010) find that British banks have large exposures to Greece (€4131 M.), Ireland (€5580 M.), Italy (€10,029 M.), Portugal (€2571 M.) and Spain (€5916 M.). Bank of England (2010) also indicated that a default by Greece or another sovereign could lead to the collapse of many European banks.

In the case of Greece, there are notable events which highlight the impact of sovereign credit signals. S&P signals are used as the examples here. On 27 April 2010, S&P downgraded Greece by three notches to BB+ (speculative-grade) from BBB+, with negative outlook. Markets in Europe, the UK and the US tumbled in reaction to this, which also signalled that the Greek crisis was spreading to other indebted states in the euro-zone. S&P then downgraded Greece to BB− on 29 March 2011, and then to B (with negative watch) on 9 May 2011. In the latter case, the yield on Greek 10-year bonds rose 21 basis points to 15.7%, and the euro slipped some 0.3% against the US dollar immediately after the announcement. On 13 June 2011, S&P downgraded Greece to CCC (with negative outlook), followed by another downgrade to CC (with negative outlook) on 27 July 2011.

3.2. Credit rating agencies and regulation

Credit rating users value both stability and accuracy of ratings (see Section 1). Many pension and mutual funds are subject to investment restrictions, and thereby a rating reversal can induce a reversal of transactions leading to substantial costs (Löffler, 2004, 2005). In addition, the regulatory capital adequacy requirements vary based on the riskiness of an institution's assets, which is often assessed using credit ratings. In this case, volatile ratings would reduce the efficiency of ratings as governance tools. Transient rating actions can be very harmful as the influences of such adjustments on market access can be hard to reverse (Langohr, 2006). On the other hand, some other rating users, such as active investors including hedge funds and traders, prefer accurate and timely ratings (Cantor et al., 2007; Cantor and Mann, 2007). Therefore, outlook and watchlist are important tools in the context of the CRAs' 'through-the-cycle' methodology.

During the global financial crisis, CRAs came under close scrutiny. Many policymakers and commentators argue that the role played by CRAs in structured finance exacerbated the crisis. For example, the high-level group chaired for the European Commission by Jacques de Larosiere stated that when rating agencies evaluated the credit risk associated with collateralised debt obligations (CDOs), there were 'flaws in their rating methodology'.[5] CRAs have also been criticised recently on the basis of inherent conflicts of interest within their business model, lack of transparency, poor communication, cliff effects and related overreliance on ratings by users (Bank of England, 2011).

In response to the perceived role of CRAs in the financial crisis, several policy actions have already occurred and new legislation has been passed in the United States and Europe. The International Organization of Securities Commissions (IOSCO) revised the Code of Conduct Fundamentals for Credit Rating Agencies in 2008 to address issues of independence, conflict of interest, transparency and competition. Also, a formal regulation on CRAs was approved by the European Parliament and entered into force in December 2009. This requires CRAs operating in Europe to register with the Committee of European Securities Regulators (CESR). The responsibility for the regulation of CRAs was handed to the European Securities and Markets Authority (ESMA) in July 2011. CRAs are now subject to legally binding rules that are based on the IOSCO Code.[6] Many other G-20 countries have introduced or are in the process of introducing new regulatory oversight for CRAs (Bank of England, 2011). Further, the Basel Committee of the Bank for International Settlements reviewed the role of external ratings in the capital adequacy framework, mainly to incorporate the IOSCO Code into the committee's eligibility criteria. The Financial Stability Board published a set of principles for reducing reliance on CRA ratings in standards, laws and regulations (FSB, 2010).

CRAs are currently accused of precipitating the sovereign debt crisis by downgrading the ratings of euro-zone sovereigns too far and too fast. Politicians across the EU have called for further regulation to improve quality and transparency in sovereign ratings. Proposals from European politicians have generated a mixed response, including the notion of a publicly owned rating agency, and a suggestion that CRAs should notify sovereigns 3 days in advance of a rating event (rather than the normal 12 h). The UK House of Lords report (2011) argues that the criticisms are largely unjustified since rating downgrades reflect the seriousness of the problems faced by euro-zone sovereigns. This report also encourages legislative changes to enhance the quality of national statistical data, and advocates that sovereigns should cooperate closely with CRAs.

The overall objective of the above regulatory changes is to reduce the impact of rating actions in financial markets, especially the mechanistic reactions induced by hardwiring and cliff effects (e.g. see Cantor et al., 2007). As regulatory changes are ongoing, we anticipate that strong market reactions would still be expected in our sample. Even after current legislation has come into full effect, one would still expect CRA signals to produce reactions if the markets continue to believe that the CRAs' views reflect private or price-relevant information. National governments are the largest borrowers in capital markets, accounting for more than 60% of debt issued (House of Lords, 2011). Therefore, sovereign ratings are still expected to impact on investors' behaviour and their risk expectations.

[5] For a formal analysis, see Benmelech and Dlugosz (2009).

[6] According to the EU Regulation, ratings issued outside the EU can be used for regulatory purposes by regulated entities in the EU by means of either endorsement or certification with ESMA.

Table 1
Descriptive statistics of the sovereign credit data sample.

		(I) Pre-crisis period			(II) Crisis period		
		Moody's	S&P	Fitch	Moody's	S&P	Fitch
1	No. of countries	35	34	36	41	42	40
2	Number of 1-notch upgrade	17	47	50	4	11	6
3	Number of >1-notch upgrade	17	1	3	0	0	2
4	Total upgrades (Rows 2 + 3)	34	48	53	4	11	8
5	Number of 1-notch downgrade	1	6	6	13	30	25
6	Number of >1-notch downgrade	1	0	1	6	4	5
7	Total downgrades (Rows 5 + 6)	2	6	7	19	34	30
8	Total actual rating changes (Rows 4 + 7)	36	54	60	23	45	38
9	Positive outlook signals	16	42	32	15	21	14
10	Negative outlook signals	3	21	16	32	54	46
11	Total outlook actions (Rows 9 + 10)	19	63	48	47	75	60
12	Positive watch signals	14	0	4	2	2	3
13	Negative watch signals	2	3	4	11	21	6
14	Total watch actions (Rows 12 + 13)	16	3	8	13	23	9
15	Total positive signals (Rows 4 + 9 +12)	64	90	89	21	34	25
16	Total negative signals (Rows 7 + 10 +13)	7	30	27	62	109	82
17	Total sovereign credit signals (Rows 8 + 11 + 14 or Rows 15 + 16)	71	120	116	83	143	107
18	Single signals for a given sovereign (rating change or watch or outlook)	65	98	92	55	85	61
19	Combined signals for a given sovereign (actual rating change and watch/outlook signal simultaneously)	6	22	24	28	58	46
20	*Percentage of signals related to:*						
	Investment-grade sovereigns (%)	48	56	55	86	66	71
	Speculative-grade sovereigns (%)	52	44	45	14	34	29
21	*Geographical origin of the credit signals:*						
	Euro-zone countries	4	16	12	21	26	19
	European non-euro-zone countries	60	99	96	58	111	78
	Central Asia	7	5	8	4	6	10
22	*The prior action preceding a rating change:*						
	Outlook signal within 6 months	3	8	10	9	12	13
	Outlook signal within 7–12 months	3	18	12	1	4	9
	Outlook signal within 13–18 months	0	5	1	0	3	1
	Outlook signal within more than 18 months	0	3	3	0	1	2
	Watch signal within 14 working days	0	1	0	1	10	2
	Watch signal within 15–90 working days	13	2	8	10	9	3
	Watch signal within 91–150 working days	1	0	0	0	0	2
	Total outlook/watch preceding rating changes	20	37	34	21	39	32
23	% of rating changes preceded by outlook/watch signals (Row 22/Row 8) (%)	56	69	57	91	87	84

This table presents summary statistics of daily long-term foreign-currency sovereign signals for countries in the 'EU–CA' region rated by each agency during: (I) pre-crisis period: 21 September 2000 to 30 September 2006; and (II) crisis period: 1 October 2006 to 31 July 2010.
Combined signals for a given sovereign are as follows. (I) Pre-crisis period: Moody's: 3 upgrade and 3 positive outlook; S&P: 8 upgrade and 8 positive outlook + 1 downgrade and 1 negative outlook + 2 downgrades and 2 negative watch; Fitch: 7 upgrade and 7 positive outlook + 1 upgrade and 1 positive watch + 3 downgrades and 3 negative outlook + 1 downgrade and 1 negative watch. (II) Crisis period: Moody's: 1 upgrade and 1 positive outlook + 11 downgrades and 11 negative outlook + 2 downgrades and 2 negative watch; S&P: 2 upgrade and 2 positive outlook + 23 downgrades and 23 negative outlook + 4 downgrades and 4 negative watch; Fitch: 20 downgrades and 20 negative outlook + 3 downgrades and 3 negative watch.

4. Data sample

4.1. Credit dataset

This consists of daily observations of long-term (LT) foreign-currency (FC) ratings, outlooks and watchlists of sovereigns rated by at least one of the three largest international CRAs (Moody's, S&P, and Fitch) during the period from 21 September 2000 to 31 July 2010. Each rating action is verified by reference to publications from the CRAs. The set of rated countries is restricted to those in the Europe–Central Asia region, as classified by the World Bank, hence, 44 countries are included. The sample period starts on 21 September 2000 because Fitch began to assign the outlook status to sovereign ratings on that date. We focus on comparing two sub-samples: (I) the pre-crisis period: 21 September 2000 to 30 September 2006; and (II) the crisis period: 1 October 2006 to 31 July 2010 (start date consistent with Arezki et al., 2011).

Table 1 summarises the sovereign credit events for each agency. We identify actual rating changes according to a 20-point numerical scale (Aaa/AAA = 20, Aa1/AA+ = 19, Aa2/AA = 18 . . . Caa3/CCC− = 2, Ca/CC, C/SD-D = 1) by notches on the basis of daily intervals. There are 135 (15) upgrades (downgrades) in the pre-crisis period, while 23 (83) upgrades (downgrades) in the crisis period (Rows 4 and 7). The majority of actual rating changes are by one-notch (Rows 2 and 5), but Moody's tends to upgrade by more than one notch far more often than other CRAs (Row 3). Some cases of 4-notch rating changes have occurred, including Moody's downgrade of Greece on 14 June 2010.

Outlook and watch signals are defined as follows. *Negative 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. *Negative* (*Positive*) *watch* signals include placing sovereign *i* on watch for possible downgrade (upgrade), and the action of confirming the rating of sovereign *i* after being on watch for possible upgrade (downgrade). The dataset of credit events comprises: 19 (47), 63 (75) and 48 (60) outlook adjustments; and 16 (13), 3 (23), 8 (9) watch announcements by Moody's, S&P and Fitch respectively, in the pre-crisis (crisis) periods (see Rows 11 and 14). It is evident that S&P is the most frequent user of outlook signals. Until July 2010, S&P had never placed a sovereign on a watch for possible upgrade (Chambers and Ontko, 2007).[7]

As a result of the financial crisis, there was a downgrade trend in sovereign credit actions during 2007–2010, with the total number of negative signals over three times greater than the positive signals (Rows 15 and 16). In contrast, the total number of positive credit signals is far greater than negative ones in the pre-crisis period. The latter feature is driven by a variety of causes fuelling economic growth in 2000–2006, such as the accession of some countries to the European Union along with higher commodity, oil and natural gas prices in emerging countries in the 'EU–CA' region. The vast majority of credit signals were announced in isolation during the pre-crisis period, whereas more than one-third of credit actions in the crisis period were combined signals (i.e. actual rating change and watch/outlook signal simultaneously) (see Rows 18 and 19).

Driven by the sovereign debt crisis, 86%, 66% and 71% of sovereign credit signals by Moody's, S&P and Fitch are related to investment-grade rated countries during the later period compared to 48%, 56% and 55% pre-crisis (see Row 20). In the pre-crisis period, more than 80% of sovereign signals in the sample related to non-euro-zone countries within Europe (see Row 21). Unsurprisingly, the number of sovereign credit signals relating to euro-zone countries considerably increased from 32 to 66 across the two periods.

S&P released a larger number of signals (263) than Moody's (154) and Fitch (223) for very similar sets of countries (Rows 1 and 17). This can be partly explained by S&P's greater emphasis than the others on short-term accuracy, and therefore it reverses its actions far more frequently. On the other hand, Moody's policy puts more weight on stability. This highlights different practices applied by CRAs in adjusting their ratings and outlook and watch status of sovereign issuers (see Sections 1 and 3.2). In the last few years, CRAs have shown an increasing tendency to use outlook and watch signals. In our sample, 91%, 87% and 84% of rating changes by Moody's, S&P and Fitch during the crisis period are directly preceded by watch or outlook signals, compared with 56%, 69% and 57%, respectively, in the pre-crisis period. Most outlook announcements occur within a year before a rating change, while most watch signals occur within 90 working days prior to a rating change (see Rows 22 and 23).

4.2. CCR Scale

We also use a 58-point numerical comprehensive credit rating scale (CCR) incorporating the actual ratings, the outlook and watch status, 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). Fig. 1 presents the behaviour of 58-point ratings of Greece, Iceland, Ireland and Portugal during the crisis period. These plots illustrate differences of both opinion and timing across CRAs. It is apparent that S&P tends to be the first mover in signalling negative news in these cases. This is in line with the findings of Alsakka and ap Gwilym (2010) that S&P demonstrates the least dependence on other CRAs (using data for all sovereigns, 1994–2009).[8] However, the position of first mover does not necessarily correspond to the CRA which has most credibility in the market, or which induces the strongest reactions to its signals.

The figures also show that only few negative actions occurred before July 2008, suggesting that the CRAs did not predict the debt problems at an early stage. For example, Moody's did not change the positive outlook of Greece (rated at 'A1′) until 25 February 2009.[9] The delayed sovereign credit announcements were also highlighted by Arezki et al. (2011).[10] In addition, it is clear that the three CRAs often disagree, whereby S&P (Moody's) mostly assigns the lowest (highest) ratings. This is consistent with Alsakka and ap Gwilym's (2010) findings that CRAs' disagreements on sovereign ratings are common, whereby Moody's tends to assign the higher sovereign ratings.

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

$$\mathrm{LCCR}_t = \ln\left[\frac{\mathrm{CCR}_t}{59 - \mathrm{CCR}_t}\right]$$

[7] On 22 July 2010, S&P placed Ukraine (rated at 'B') on positive watch. Ukraine was upgraded to 'B+' one week later. This is the only time for S&P to place a sovereign on positive watch. On 25 September 2008, S&P confirmed the 'B' rating of Georgia after it being on negative watch.

[8] Alsakka and ap Gwilym (2010) show that S&P tends to lead Moody's rating downgrades, and S&P also leads Fitch upgrades and downgrades to a greater extent than vice versa.

[9] However, controversy about national economic data was another element in the unfolding of the crisis. For example, in late 2009, Greece's budget deficit was revised from a forecast of 6–8% of GDP to 12.7%, and further revised to 15.4% in 2010 under IMF/EU supervision.

[10] Very little indication of reversals in rating judgements exists in Fig. 1. We return to this point in Section 6.

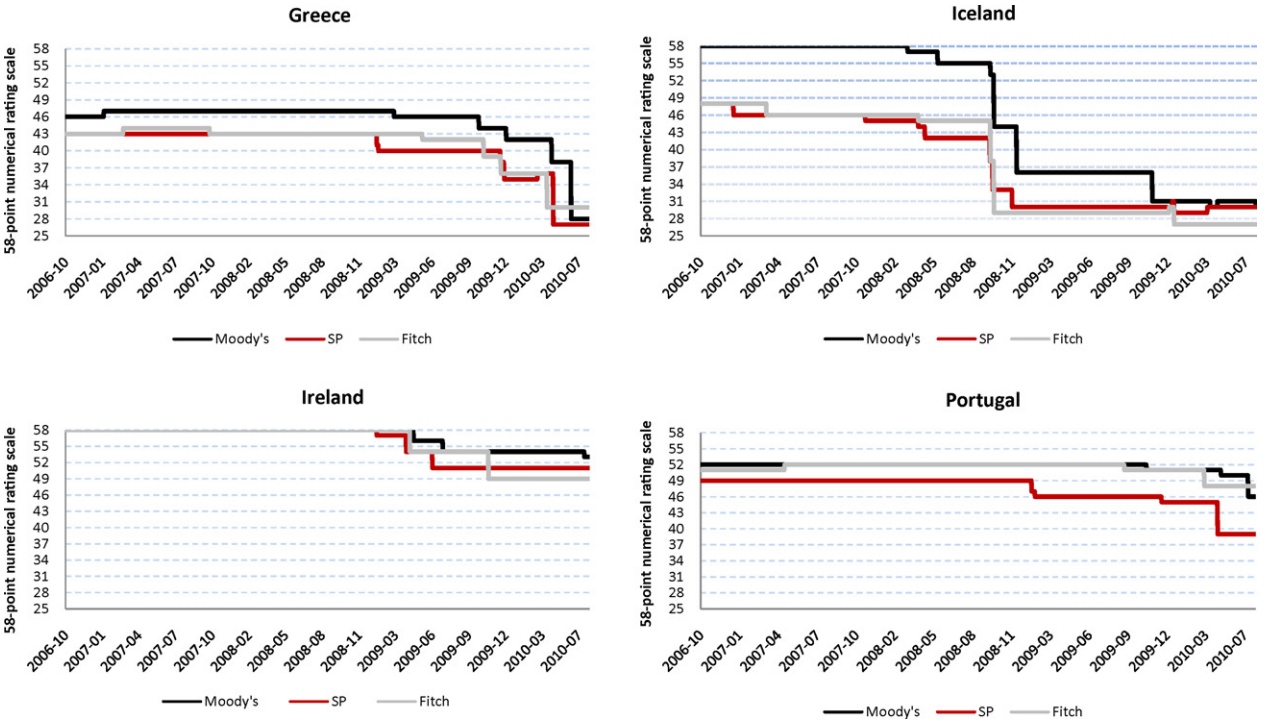

Fig. 1. The behaviour of 58-point ratings of Greece, Iceland, Ireland and Portugal during the crisis period (October 2006–July 2010). The credit ratings scale is transformed into a 58-point numerical scale (Aaa/AAA = 58, Aa1/AA+ = 55 . . . Caa3/CCC− = 4, Ca/CC, C/SD-D = 1), and we add '+2′ for positive watch, '+1′ for positive outlook, '−1′ for negative outlook, '−2′ for negative watch, and '0′ for stable outlook and no watch/outlook assignments.

CCR_t is the rating according to the 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.

4.3. The foreign exchange data

The spot foreign exchange market is the largest and most liquid financial market, with an average daily trading volume of US$4.0 trillion in 2010 (BIS, 2010). We focus 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[11] and the particular importance of US dollar in global financial markets.[12] 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 (e.g. Hooper et al., 2008). We only include exchange rates for the 44 countries in 'EU–CA' that are rated by at least one CRA. The daily spot exchange rates are obtained from DataStream, and the primary source is Thomson Reuters. With regard to member countries which joined the euro-zone after September 2000, data is included in the sample from when they first started using the Euro: (i) from 2001 for Greece; (ii) from 2007 for Slovenia; (iii) from 2008 for Cyprus and Malta; and (iv) from 2009 for the Slovak Republic.[13]

In our sample, 66% of the countries are in the floating/free floating exchange rate categories based on the end-April 2010 IMF de facto classification. This classification identifies ten categories, and the IMF frequently reclassifies countries based on observed actions (see IMF, 2010c). The issue of whether a particular exchange rate regime should be considered as fixed or floating is a controversial task that has become a stand-alone research area (e.g. Dubas et al., 2010) and therefore is not a focus here. Hence, we do not control for the category of exchange rate regime, which implies conservatism in the impact of news in our estimations.

[11] However, the USA sovereign rating was placed on 'negative outlook' by S&P on 18 April 2011, placed on 'negative watch' on 14th July 2011, and downgraded to 'AA+' on 5th August 2011. It was placed on 'negative watch' by Moody's on 13th July 2011, then removed on 2nd August 2011, but placed on 'negative outlook'.

[12] BIS (2010) reports that 85% of trades in the foreign exchange market have one side denominated in US$.

[13] On 1 January 2011, Estonia joined the euro zone.

5. Methodology

Based on the discussion in the preceding sections, we test the following hypotheses.

Firstly, relating to the effect of CRA sovereign news on own-country exchange rates:

$H1_0$. CRA news has a significant and immediate impact on exchange rates in the 'EU–CA' region, but the impact of outlook and watch signals is stronger than the impact of rating changes. The effect is stronger in the 2006–2010 crisis period.

$H1_a$. Rating stability and the negative reputational effects arising from the US subprime crisis mean that markets do not respond significantly to CRA news.

Secondly, relating to the spillover effects of CRA sovereign news:

$H2_0$. CRA news for country *i* significantly and immediately affects other currencies in the 'EU–CA' region, and the effect is stronger in the 2006–2010 crisis period.[14] The spillover effects from outlook and watch signals are stronger than from rating changes.

$H2_a$. Rating stability and the reduced reputation of CRAs means there is little spillover arising from sovereign credit signals during the crisis period.

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

$$\Delta EX_{i,s} = \alpha + \beta \Delta LCCR_{it} + \delta CCR_{it} + \lambda Spread_t + \xi Co_i + \gamma y_i + \varepsilon_{it} \quad (1)$$

$\Delta EX_{i,s}$ 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]. The time windows start at date $t-1$ in order to account for time zone differences. To control for the potential influence of temporal clustering of events in other countries (i.e. to avoid any information contamination problem), we measure the change in spot foreign exchange rates over short windows. Gande and Parsley (2005) and Ferreira and Gama (2007), for example, use a standard 2-day window only. $\Delta LCCR_{it}$ is the 1-day change in the logit-type transformation of the 58-point rating (see Section 4.2) for sovereign *i* at event date *t*. 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.[15] For ease of interpretation, the absolute value of $\Delta LCCR_{it}$ is used in the regression utilising negative credit signals. CCR_{it} is the level of event country *i* comprehensive credit rating. This is considered as a proxy controlling for the economic, financial and political conditions of country *i*. This allows the impact of sovereign credit news to vary with the credit rating (i.e. the economic and financial position) of the country under consideration. $Spread_t$ is the spread between yields on Moody's Baa and Aaa corporate bonds (for all industries) in the US at date *t*. This is included to control for the US economic cycle. Fama and French (1989) and others show that this spread tends to rise during economic contractions and fall during expansions. Co_i is a full set of event country dummies and y_i is a full set of year dummies.

In the second element of analysis, we distinguish between the effects of different types of credit signals across CRAs (rating upgrade, rating downgrade, positive and negative outlook actions, and positive and negative watch announcements) as follows:

$$\Delta EX_{i,s} = \alpha + \beta_1 UP_{it} + \beta_2 PO_{it} + \beta_3 PW_{it} + \beta_4 DN_{it} + \beta_5 NO_{it} + \beta_6 NW_{it} + \delta CCR_{it} + \lambda Spread_t + \xi Co_i + \gamma y_i + \varepsilon_{it} \quad (2)$$

UP_{it} (DN_{it}) is a dummy variable taking the value of 1 if sovereign *i* is upgraded (downgraded) at time *t*, zero otherwise. There are very few observations at more than one-notch upgrade (downgrade) categories, which are therefore merged together into this category (see Table 1, Rows 3 and 6). 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. CCR_{it}, $Spread_t$, Co_i and y_i are included as for Eq. (1).

Eqs. (1) and (2) are estimated using all sovereigns in the 'EU–CA' region from each CRA separately for two sub-samples: (I) pre-crisis period, and (II) crisis period. These estimations aim to underline any differentials in the market reaction to CRA news before and during the crisis, and to highlight any unequal effects across CRAs.

We then proceed to examine whether sovereign credit news for one country *i* has an impact on the currency of another country *j*. We follow the modelling approach used by Gande and Parsley (2005) and Ferreira and Gama (2007) in their investigation of equity and bond market reactions to sovereign credit events. However, we employ the logit-type transformation of the 58-point numerical ratings to address possible non-linearity in the numerical rating scale. Hence, the variable of interest in verifying the existence of spillovers is the exchange rate response of country *j* to the event of a change in the transformed 58-point numerical rating of country *i*. For each sovereign credit event (i.e. only non-zero values of $\Delta LCCR$), we pool the exchange rate changes of all countries *j* excluding the event country *i* at event time *t*. Hence, rated countries that

[14] Cross exchange rate arbitrage would be one obvious channel through which news is transmitted to other exchange rates.

[15] The reverse direction of causality is highly implausible, i.e. changes in the exchange rate over a very short horizon will not induce a rating agency to issue a sovereign credit signal.

have never experienced any sovereign credit events are not included in the events series, however, their exchange rates are still considered in order to examine whether they are affected by credit signals related to any other sovereigns in the same region.[16] For the 16 euro-zone states, all credit events announced for these states are included in the events series, but the euro-US$ exchange rate is taken into account just once for each event related to non-euro-zone countries. The specification is:

$$\Delta EX_{j,s} = \alpha + \beta_1 \Delta LCCR_{i,t} + \delta CCR_{it} + \delta_2 CCR_{jt} + \lambda Spread_t + \sum_k \xi Co_k + \gamma y_{ij} + \varepsilon_{ij,t}, \quad \forall j \neq i \tag{3}$$

$\Delta EX_{j,s}$ is the 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 for country i: [−1, +1], [−1, +3], [−1, +7], [−1, +14], and [−1, +30]. $\Delta LCCR_{it}$ is the 1-day change in the logit-type transformation of the 58-point rating of event country i at event date t. We examine negative and positive signals separately and the absolute value of $\Delta LCCR_{it}$ is used in the regression with negative credit signals. CCR_{it} is the level of event country i comprehensive credit rating and CCR_{jt} is the level of non-event country j comprehensive credit rating. CCR_{it} and CCR_{jt} are included to control for variation in market reaction relative to the position of each country pair on the 58-point rating scale. Consequently, we allow the effects of credit signals to vary with the credit rating of both countries under consideration. For example, the spillover effects from credit signals for a sovereign rated AA might differ from those for another rated BBB (see Gande and Parsley, 2005; Ferreira and Gama, 2007). $Spread_t$ is the spread between yields on Moody's Baa and Aaa corporate bonds (all industries) in the US at date t. This is included in order to control for the US economic cycle. Matrix Co includes event country and non-event country dummies. y_{ij} is a full set of year dummies.

Finally, we distinguish between the spillover effects of different types of credit signals across CRAs (using samples of events dates only as in Eq. (3)), as follows:

$$\Delta EX_{j,s} = \alpha + \beta_1 UP_{it} + \beta_2 PO_{it} + \beta_3 PW_{it} + \beta_4 DN_{it} + \beta_5 NO_{it} + \beta_6 NW_{it} + \delta_1 CCR_{it} + \delta_2 CCR_{jt} + \lambda Spread_t + \sum_k \xi Co_k + \gamma y_{ij} + \varepsilon_{ij,t} \quad \forall j \neq i \tag{4}$$

where UP_{it} (DN_{it}); PO_{it} (NO_{it}); and/or PW_{it} (NW_{it}) are dummy variables taking the value of 1 if event sovereign i experiences a rating upgrade (downgrade); positive (negative) outlook signal; and/or positive (negative) watch action at event date t, zero otherwise.

$\Delta EX_{j,s}$, CCR_{it}, CCR_{jt}, $Spread_t$, Co_k and y_i are defined as in Eq. (3).

Eqs. (3) and (4) are estimated using credit events for countries in the 'EU–CA' region from each CRA separately for two sub-samples: (I) pre-crisis period, and (II) crisis period.

In general, 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, and negative signs for the coefficients on positive credit signals, in all equations. In order to obtain robust estimators to any potential heteroscedasticity and/or autocorrelation in the residuals, a White correction is performed on the standard deviation of the estimated coefficients in all equations (Gande and Parsley, 2005; Ferreira and Gama, 2007; Arezki et al., 2011).

6. Empirical results

Section 6.1 discusses the results of the own-country exchange rate responses to credit signals prior to and during the crisis (Eqs. (1) and (2)). Section 6.2 analyses the results of the spillover effects of credit signals (Eqs. (3) and (4)).

6.1. Own-country exchange rate responses to sovereign credit news

6.1.1. Pre-crisis period

Table 2 presents estimates of the coefficients of Eq. (1) using data for 'EU–CA' sovereigns rated by Moody's, S&P and Fitch separately, during the pre-crisis period. The variable of interest is 'ΔLCCR', representing the 1-day change in the logit-type transformation of the 58-point rating of sovereign i at event date t. There is evidence that sovereign credit signals produce an asymmetric effect in that negative signals by S&P and Fitch are associated with significant currency depreciations, but positive signals show very little impact. Moody's actions have no significant effects. S&P negative signals are associated with significant currency depreciations by 1.83% and 1.22% in the [−1, +1] and [−1, +3] event windows. Exchange rates respond to Fitch negative signals in the [−1, +1] [−1, +3] and [−1, +7] event windows by 1.32%, 1.41% and 1.16%, respectively.

Table 3 reports estimates of the coefficients of Eq. (2) for the pre-crisis period. In this analysis, we aim to disentangle the effects of various types of sovereign credit signals. All significant variables have the expected sign. Consistent with Table 2, all

[16] For example, Switzerland did not experience a sovereign credit event during the sample period, and therefore, does not appear in the 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. Also, recall that non-rated countries in 'EU-CA' are excluded from the exchange rate data.

Table 2
Own-country exchange rate responses to sovereign credit signals during the pre-crisis period.

	Positive signals						Negative signals					
	Moody's		S&P		Fitch		Moody's		S&P		Fitch	
	Coeff	*t*-Val	Coeff	*t*-Val	Coeff	*t*-Val	Coeff	*t*-Val	Coeff	*t*-Val	Coeff	*t*-Val
[−1, +1]												
Constant	.0002	0.24	.0022[b]	2.47	−.0012[a]	−3.54	.0002	0.24	−.0001	−0.38	−.0011[a]	−3.33
ΔLCCR	−.0008	−0.97	−.0018	−0.94	.0008	0.58	.0004	0.10	.0183[c]	1.82	.0132[c]	1.81
CCR	−.0009[b]	−2.27	−.0010[b]	−2.32	−.0009[b]	−2.18	−.0010[b]	−2.26	−.0001[a]	−4.12	−.0008[b]	−2.09
Spread	−.0001[b]	−2.15	−.0001[a]	−4.47	−.0001[a]	−3.58	−.0001[c]	−1.92	−.0001[b]	−2.26	−.0001[a]	−3.10
Y/Co	Yes		Yes		Yes		Yes		Yes		Yes	
Adj-R^2	0.74%		0.79%		0.71%		0.74%		1.25%		0.75%	
Obs.	51,817		49,989		52,519		51,763		49,932		52,461	
[−1, +3]												
Constant	.0009	0.75	.0045[a]	3.50	−.0020[a]	−3.82	.0009	0.66	−.0001	−0.01	−.0018[a]	−3.64
ΔLCCR	−.0006	−0.61	−.0011	−0.43	−.0030	−1.08	.0006	0.12	.0122[c]	1.88	.0141[c]	1.79
CCR	−.0013[b]	−2.06	−.0013[b]	−2.12	−.0011[c]	−1.94	−.0012[b]	−2.12	−.0001[a]	−5.67	−.0011[c]	−1.83
Spread	−.0001[a]	−3.06	−.0001[a]	−5.86	−.0001[a]	−4.36	−.0001[a]	−2.69	−.0013[b]	−2.07	−.0001[a]	−3.90
Y/Co	Yes		Yes		Yes		Yes		Yes		Yes	
Adj-R^2	1.35%		1.45%		2.72%		1.35%		1.58%		1.35%	
Obs.	51,817		49,989		52,519		51,763		49,932		52,461	
[−1, +7]												
Constant	−.0005	−0.30	.0069[a]	3.83	−.0064[a]	−9.01	−.0004	−0.25	−.0028[a]	−3.06	−.0063[a]	−8.90
ΔLCCR	.0003	0.14	.0002	0.06	−.0045	−0.96	.0021	0.30	.0068	0.56	.0116[c]	1.68
CCR	−.0042[a]	−5.29	−.0043[a]	−5.29	−.0040[a]	−5.10	−.0041[a]	−5.11	−.0003[a]	−8.57	−.0039[a]	−5.01
Spread	−.0001[a]	−4.61	−.0003[a]	−8.58	−.0002[a]	−5.75	−.0001[a]	−4.09	−.0043[a]	−5.22	−.0002[a]	−5.43
Y/Co	Yes		Yes		Yes		Yes		Yes		Yes	
Adj-R^2	2.78%		2.99%		2.16%		2.78%		3.03%		2.75%	
Obs.	51,817		49,989		37,992		51,763		49,932		52,461	
[−1, +14]												
Constant	.0002	0.10	.0145[a]	6.13	−.0119[a]	−12.50	.0003	0.14	−.0045[a]	−3.89	−.0117[a]	−12.39
ΔLCCR	−.0030	−0.84	−.0078	−1.45	−.0034	−0.58	.0033	0.36	.0105	0.95	.0116	0.59
CCR	−.0054[a]	−5.25	−.0055[a]	−5.20	−.0051[a]	−5.05	−.0053[a]	−5.00	−.0001[a]	−12.4	−.0050[a]	−4.94
Spread	−.0003[a]	−6.86	−.0005[a]	−12.5	−.0003[a]	−7.66	−.0002[a]	−6.12	−.0055[a]	−5.11	−.0003[a]	−7.35
Y/Co	Yes		Yes		Yes		Yes		Yes		Yes	
Adj-R^2	5.37%		5.80%		5.29%		5.37%		5.86%		5.32%	
Obs.	51,817		49,989		52,519		51,763		49,932		52,461	
[−1, +30]												
Constant	.0021	0.65	.0293[a]	8.27	−.0218[a]	−15.46	.0021	0.557	−.0075[a]	4.30	−.0217[a]	−15.35
ΔLCCR	−.0013	−0.39	−.0101[c]	−1.81	.0031	0.36	.0036	0.27	.0193	1.02	.0026	0.14
CCR	−.0107[a]	−7.33	−.0109[a]	−7.15	−.0106[a]	−7.36	−.0106[a]	−6.81	−.0010[a]	−15.9	−.0104[a]	−7.21
Spread	−.0005[a]	−9.25	−.0010[a]	−15.9	−.0007[a]	−9.85	−.0004[a]	−8.22	−.0108[a]	−7.04	−.0007[a]	−9.54
Y/Co	Yes		Yes		Yes		Yes		Yes		Yes	
Adj-R^2	9.96%		10.68%		9.84%		9.95%		10.76%		9.86%	
Obs.	51,817		49,989		52,519		51,763		49,932		52,461	

The table presents the coefficient estimates of Eq. (1) using data samples of 'EU–CA' countries rated by Moody's, S&P and Fitch during September 2000–September 2006. $\Delta EX_{i,s}$: the dependent variable, is the change in the natural logarithm of the exchange rate of sovereign *i* per US$ in the following time windows around the credit event date *t*: [−1, +1], [−1, +3] [−1, +7], [−1, +14] and [−1, +30]. $\Delta LCCR_{it}$ is the 1-day change in the logit-type transformation of the 58-point rating scale of sovereign *i* at date *t*. We examine negative and positive signals separately. Given currency appreciation/depreciation, a negative coefficient is expected for positive signals (and vice versa). CCR: the level of event country comprehensive credit rating. Spread: the spread between yields on Moody's Baa and Aaa corporate bonds in the US Full sets of year/country dummies are included. We apply Huber–White robust standard errors.

[a] Significant at 1% level.
[b] Significant at 5% level.
[c] Significant at 10% level.

types of Moody's actions have insignificant effects on the exchange rate. For S&P and Fitch, it is evident that negative outlook and negative watch events are those associated with a significant impact on exchange rates.[17] However, rating downgrades have an insignificant impact. This is not surprising given that in some cases the rating changes are anticipated since market participants are aware of the prior rating outlook/watch status. Table 1, Row 23, shows that more than 50% of actual rating changes in this sample are preceded by outlook/watch signals. The effects of negative watch announcements by S&P and Fitch are stronger than outlook signals. Negative watch signals by S&P significantly depreciate the currency by 19.42% and

[17] It should be noted that negative watch signals are relatively rare in the pre-crisis period (Row 13 of Table 1). However, the evidence suggests that they contained substantial surprise elements.

Table 3
Own-country exchange rate responses to sovereign credit signals during the pre-crisis period – various signal types.

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	−.0007	−1.49	−.0009	−1.40	−.0044[a]	−4.72	−.0075[a]	−6.06	−.0129[a]	−7.13
UP	.0003	0.20	−.0010	−0.47	.0001	0.01	−.0003	−0.08	−.0014	−0.25
PO	.0007	0.32	−.0014	−0.37	−.0038	−0.88	−.0052	−0.91	−.0092	−1.09
PW	.0008	0.33	− .0052	− 1.57	−.0011	−0.24	−.0019	−0.31	.0002	0.03
DN	.0003	0.05	−.0006	−0.08	−.0043	−0.35	−.0072	−0.44	−.0099	−0.42
NO	.0030	0.59	.0038	0.53	.0001	0.02	.0163	1.24	.0014	0.07
NW	−.0006	−0.09	−.0063	−0.72	−.0052	−0.43	.0208	1.29	.0352	1.49
CCR	−.0001[c]	−1.91	−.0001[a]	−2.72	−.0001[a]	−4.61	−.0002[a]	−6.10	−.0004[a]	−8.24
Spread	−.0009[b]	−2.26	−.0012[b]	−2.18	−.0042[a]	−5.28	−.0053[a]	−5.06	−.0107[a]	−6.87
Y/Co	Yes		Yes		Yes		Yes		Yes	
Adj-R^2	0.74%		1.36%		2.78%		5.38%		9.96%	
No. of obs.	51,824		51,824		51,824		51,824		51,824	
Panel II – S&P										
Constant	−.0002	−1.40	−.0001	−1.04	−.0028[a]	−3.11	−.0047[a]	−3.92	−.0075[a]	−4.31
UP	.0005	0.46	−.0010	−0.55	.0009	0.34	.0029	0.94	.0061	1.02
PO	−.0006	−0.42	.0013	0.57	−.0013	−0.43	−.0014	−0.34	−.0039	−0.68
PW	No actions (See Table 1, Panel I)									
DN	.0583	1.36	.0584	1.30	.0450	1.20	.0478	1.22	.0953[c]	1.68
NO	.0076[c]	1.74	.0051[c]	1.85	.0063	0.86	.0095	1.22	.0088	0.73
NW	.1942[c]	1.75	.1609[c]	1.73	.0961	0.98	.1192	1.21	.2670[c]	1.82
CCR	−.0001[a]	−4.47	−.0001[a]	−5.85	−.0002[a]	−8.62	−.0005[a]	−12.5	−.0010[a]	−16.0
Spread	−.0010[b]	−2.35	−.0013[b]	−2.11	−.0043[a]	−5.25	−.0056[a]	−5.19	−.0108[a]	−7.11
Y/Co	Yes		Yes		Yes		Yes		Yes	
Adj-R^2	2.89%		2.20%		3.14%		5.93%		10.59%	
No. of obs.	50,015		50,015		50,015		50,015		50,015	
Panel III – Fitch										
Constant	.0018[c]	1.73	.0036[b]	2.31	.0039[c]	1.81	.0067[b]	2.42	.0145[a]	3.46
Up	−.0011	−1.11	−.0014	−0.95	−.0026	−1.37	−.0014	−0.46	.0025	0.56
PO	−.0033	−1.42	−.0009	−0.26	−.0046	−1.62	−.0012	−0.37	−.0022	−0.41
PW	.0002	0.17	−.0022	−0.56	.0015	0.57	−.0086	−0.74	.0094	0.68
DN	.0003	0.03	.0052	0.34	−.0021	−0.12	−.0091	−0.44	−.0059	−0.16
NO	.0060[c]	1.65	.0105[c]	1.78	.0117[c]	1.68	.0197	1.49	.0190	1.03
NW	.1243[c]	1.68	.1326[c]	1.73	.1189[c]	1.84	.1283[c]	1.74	.1519	1.28
CCR	−.0001[a]	−3.27	−.0001[a]	−4.09	−.0002[a]	−5.54	−.0003[a]	−7.49	−.0007[a]	−9.68
Spread	−.0008[b]	−2.16	−.0011[c]	−1.90	−.0040[a]	−5.06	−.0050[a]	−5.00	−.0105[a]	−7.29
Y/Co	Yes		Yes		Yes		Yes		Yes	
Adj-R^2	2.20%		2.20%		3.12%		5.55%		9.99%	
No. of obs.	52,542		52,542		52,542		52,542		52,542	

The table presents the coefficient estimates of Eq. (2) using data samples of 'EU–CA' countries rated by Moody's, S&P and Fitch during September 2000–September 2006. $\Delta EX_{i,s}$ the dependent variable, is the change in the natural logarithm of the exchange rate of sovereign *i* per US$ in the following time windows around the credit event date *t*: [−1, +1], [−1, +3] [−1, +7], [−1, +14] and [−1, +30]. UP_{it} (DN_t) takes the value of 1 if sovereign *i* is upgraded (downgraded) at time *t*, zero otherwise. PO_{it} (NO_{it}) takes the value of 1 if sovereign *i* experiences a *positive* (*negative*) *outlook* action at time *t*, zero otherwise. PW_{it} (NW_{it}) takes the value of 1 if sovereign *i* experiences a *positive* (*negative*) *watch* action at time *t*, zero otherwise. Due to currency appreciation/depreciation, a negative (positive) coefficient is expected for positive (negative) signals. CCR the level of event country comprehensive credit rating. Spread the spread between yields on Moody's Baa and Aaa corporate bonds in the US. Full sets of year and country dummies are included. We apply Huber–White robust standard errors.

[a] Significant at 1% level.
[b] Significant at 5% level.
[c] Significant at 10% level.

16.09% in the [−1, +1] and [−1, +3] event windows, compared to 0.76% and 0.51% for S&P negative outlook signals. Similarly, negative watch signals by Fitch lead to currency depreciations by 12.43%, 13.26% and 11.89% in the [−1, +1], [−1, +3] and [−1, +7] event windows, compared to 0.60%, 1.05% and 1.17% for Fitch negative outlook signals. Overall, this is strongly consistent with Hypothesis $H1_0$.

Importantly, in Tables 2 and 3, the level of comprehensive credit rating (CCR) is always negative and significant. This implies that the higher the credit rating of the sovereign, the weaker the effect of CRA news on the exchange rate. This is mainly driven by the stable economies of western European countries prior to the crisis. Similarly, the US quality spread is also always negative and significant. This implies that the US dollar tends to strengthen when US credit conditions are more benign.

Table 4
Own-country exchange rate responses to sovereign credit signals during the crisis period.

	Positive signals						Negative signals					
	Moody's		S&P		Fitch		Moody's		S&P		Fitch	
	Coeff	*t*-Val	Coeff	*t*-Val	Coeff	*t*-Val	Coeff	*t*-Val	Coeff	*t*-Val	Coeff	*t*-Val
[−1, +1]												
Constant	−.0054[a]	−2.72	−.0036[b]	−2.41	−.0036[b]	−2.12	−.0025[a]	−4.06	−.0060[a]	−3.23	−.0036[b]	−2.40
ΔLCCR	−.0203[c]	−1.72	−.0043	−0.48	−.0058	−0.73	.0140[a]	2.95	.0080[c]	1.70	.0160[a]	3.50
CCR	.0001[b]	2.23	.0001[c]	1.91	.0001	1.39	.0001[a]	2.97	.0001[b]	2.53	.0001[c]	1.66
Spread	.0001	1.15	.0002	1.57	.0002	1.27	.0001	1.48	.0002[b]	2.44	.0002[b]	2.10
Y/Co	Yes		Yes		Yes		Yes		Yes		Yes	
Adj-R^2	0.43%		0.44%		0.41%		0.44%		0.45%		0.46%	
Obs.	38,958		38,269		38,226		38,986		38,311		38,254	
[−1, +3]												
Constant	−.0047[a]	−7.23	−.0072[a]	−3.30	−.0076[a]	−3.01	−.0049[a]	−5.55	−.0111[a]	−4.33	−.0075[a]	−3.54
ΔLCCR	−.0068	−0.69	−.0156	−1.04	.0020	0.25	.0178[a]	2.68	.0075[c]	1.74	.0107[c]	1.67
CCR	.0001[a]	2.97	.0001[b]	2.50	.0001[b]	2.01	.0002[a]	3.85	.0001[a]	3.23	.0001[b]	2.52
Spread	.0002	1.07	.0003[c]	1.74	.0003	1.41	.0002	1.38	.0004[a]	2.73	.0003[b]	2.23
Y/Co	Yes		Yes		Yes		Yes		Yes		Yes	
Adj-R^2	0.95%		1.00%		0.95%		0.97%		0.88%		0.86%	
Obs.	38,881		38,187		38,148		38,909		38,230		38,176	
[−1, +7]												
Constant	−.0211[a]	−5.50	−.0137[a]	−4.19	−.0154[a]	−5.15	−.0090[a]	−7.20	−.0139[a]	−4.32	−.0151[a]	−5.04
ΔLCCR	−.0221[c]	−1.66	−.0124	−0.74	−.0240	−0.83	.0151[c]	1.66	.0033	0.36	.0228[b]	2.53
CCR	.0002[a]	4.26	.0002[a]	3.40	.0002[a]	3.96	.0003[c]	5.10	.0003[a]	4.14	.0002[a]	3.84
Spread	.0001	0.49	.0005[c]	1.73	.0003[c]	1.70	.0001	0.64	.0005[a]	2.61	.0004[c]	1.86
Y/Co	Yes		Yes		Yes		Yes		Yes		Yes	
Adj-R^2	2.90%		2.29%		2.16%		2.12%		2.14%		2.21%	
Obs.	38,711		38,024		37,992		38,753		38,067		38,020	
[−1, +14]												
Constant	−.0150[a]	−12.1	−.0229[a]	−4.20	−.0249[a]	−5.11	−.0153[a]	−8.98	−.0285[a]	−5.73	−.0244[a]	−5.89
ΔLCCR	−.0334[c]	−1.83	−.0240	−0.90	−.0114	−0.59	.0032	0.25	.0253[b]	1.99	.0045	0.37
CCR	.0004[a]	5.69	.0003[a]	3.38	.0003[a]	3.65	.0005[a]	6.25	.0003[a]	3.99	.0003[a]	4.46
Spread	−.0001	−0.23	.0006	1.41	.0003	0.75	−.0001	−0.41	.0005[b]	1.97	.0003	1.13
Y/Co	Yes		Yes		Yes		Yes		Yes		Yes	
Adj-R^2	4.62%		5.03%		4.83%		4.64%		5.02%		4.86%	
Obs.	38,455		37,738		37,719		38,480		37,780		37,748	
[−1, +30]												
Constant	−.0259[a]	13.7	−.0408[a]	−4.31	−.0396[a]	−6.38	−.0659[a]	−8.84	−.0404[a]	−5.40	−.0391[a]	−6.31
ΔLCCR	−.0063	−0.17	−.0845[b]	−2.01	−.0714	−1.04	.0270	1.28	.0347[c]	1.85	.0332[c]	1.82
CCR	.0008[a]	7.00	.0004[a]	3.33	.0006[a]	5.22	.0009[a]	7.47	.0004[a]	3.69	.0006[a]	5.14
Spread	−.0024[a]	−4.24	−.0014[b]	−2.57	−.0019[a]	−4.37	−.0024[a]	−5.40	−.0014[a]	−3.40	−.0019[a]	−4.36
Y/Co	Yes		Yes		Yes		Yes		Yes		Yes	
Adj-R^2	9.70%		10.35%		9.95%		9.73%		10.23%		10.09%	
Obs.	37,832		37,082		37,095		37,856		37,124		37,125	

The table presents the coefficient estimates of Eq. (1) using data samples of 'EU–CA' countries rated by Moody's, S&P and Fitch during October 2006–July 2010. $\Delta EX_{i,s}$ the dependent variable, is the change in the natural logarithm of the exchange rate of sovereign *i* per US$ in the following time windows around the credit event date *t*: [−1, +1], [−1, +3] [−1, +7], [−1, +14] and [−1, +30]. $\Delta LCCR_{it}$ is the 1-day change in the logit-type transformation of the 58-point rating scale of sovereign *i* at date *t*. We examine negative and positive signals separately. Given currency appreciation/depreciation, a negative coefficient is expected for positive signals (and vice versa). CCR the level of event country comprehensive credit rating. Spread the spread between yields on Moody's Baa and Aaa corporate bonds in the US. Full sets of year/country dummies are included. We apply Huber–White robust standard errors.

[a] Significant at 1% level.
[b] Significant at 5% level.
[c] Significant at 10% level.

6.1.2. Crisis period

Table 4 documents the estimated coefficients of Eq. (1) using data for the crisis period. Moody's positive news is associated with significant currency appreciations in the [−1, +1], [−1, +7] and [−1, +14] event windows by 2.03%, 2.21% and 3.34%. However, positive actions by S&P and Fitch generally have no significant effects (except S&P for the [−1, +30] window). This is in line with Brooks et al.'s (2004) finding that Moody's upgrades only are associated with a positive abnormal stock index return, Afonso's (2011) results that sovereign yield spreads react to positive news from Moody's only, and with the findings of Alsakka and ap Gwilym (2010) that Moody's tends to be the first mover in upgrading sovereigns. Negative news by all three CRAs is associated with significant currency depreciations in most time windows. The impact of Fitch negative news is slightly stronger than for Moody's and S&P. Fitch negative signals cause an immediate currency depreciation (i.e. in the [−1, +1] window) by 1.60% compared with 0.80% by S&P and 1.40% by Moody's. Similarly, Fitch negative actions lead to currency depreciation in the [−1, +7] time window by 2.28% compared with 1.51% for Moody's and insignificant for S&P.

Table 5
Own-country exchange rate responses to sovereign credit signals during the crisis period – various signal types.

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	−.0064[a]	−3.19	−.0048[a]	−7.42	−.0089[a]	−9.60	−.0379[a]	−7.49	−.0653[a]	−8.72
UP	−.0030	−0.77	−.0022	−0.54	−.0039	−0.71	−.0030	−1.28	−.0008	−0.12
PO	−.0023[c]	−1.72	−.0010	−0.84	.0001	0.03	−.0021[c]	−1.83	−.0152[b]	−2.54
PW	−.0033[c]	−1.65	−.0002	−1.05	−.0032[b]	−2.28	−.0177[a]	−3.86	−.0435[c]	−1.81
DN	.0162[c]	1.73	.0231[c]	1.84	.0293[b]	2.05	.0166	1.30	.0243	1.05
NO	.0009	0.22	.0042	0.55	.0116	0.83	.0027	0.28	.0052	0.27
NW	.0177[c]	1.74	.0203[c]	1.67	.0204[c]	1.66	.0201	1.08	.0572	1.49
CCR	.0001[b]	2.50	.0001[a]	3.28	.0003[a]	4.53	.0005[a]	5.94	.0009[a]	7.20
Spread	.0001	1.03	.0002	0.95	.0001	0.40	−.0001	−0.31	−.0024[a]	−4.33
Y/Co	Yes		Yes		Yes		Yes		Yes	
Adj-R^2	0.54%		1.03%		2.17%		4.65%		9.76%	
No. of obs.	39,007		38,929		38,773		38,500		37,876	
Panel II – S&P										
Constant	−.0037[b]	−2.53	−.0073[a]	−3.73	−.0137[a]	−4.20	−.0283[a]	−5.20	−.0400[a]	−5.13
UP	.0011	0.43	.0001	0.02	−.0039	−0.87	−.0092	−1.61	−.0315[a]	−3.42
PO	−.0009	−0.47	−.0027	−0.84	.0013	0.32	.0027	0.38	.0050	0.60
PW	−.0007	−0.59	−.0013	−0.54	−.0060	−0.83	.0006	0.66	.0112	0.84
DN	.0055	1.13	.0059	0.75	.0043	0.67	.0055	0.56	.0095	0.87
NO	.0050[c]	1.82	.0065[c]	1.74	.0066[c]	1.73	.0097[c]	1.66	.0130	1.41
NW	.0132[b]	2.36	.0170[c]	1.88	.0242[b]	2.23	.0202[c]	1.91	.0252[c]	1.67
CCR	.0001[b]	2.13	.0001[a]	2.66	.0002[a]	3.41	.0003[a]	3.50	.0004[a]	3.41
Spread	.0002	1.60	.0004[c]	1.78	.0005[c]	1.73	.0005	1.34	.0014	2.55
Y/Co	Yes		Yes		Yes		Yes		Yes	
Adj-R^2	0.54%		1.08%		2.34%		5.04%		10.36%	
No. of obs.	38,347		38,265		38,101		37,814		37,158	
Panel III – Fitch										
Constant	−.0031[a]	−3.11	−.0062[a]	−4.72	−.0121[a]	−6.52	−.0198[a]	−7.76	−.0326[a]	−8.56
Up	−.0015	−0.37	−.0019	−0.33	−.0055	−0.68	−.0029	−0.24	−.0230	−1.19
PO	−.0053	−1.58	−.0044	−0.99	−.0006	−0.10	−.0003	−0.04	−.0115	−0.91
PW	.0028	0.42	.0025	0.27	.0009	0.07	.0064	0.72	.0184	0.68
DN	.0077[a]	2.98	.0029[c]	1.77	.0071[b]	2.11	.0111	1.53	.0081	0.77
NO	.0025	0.19	.0042	1.43	.0072	0.73	−.0005	−0.03	.0029	0.36
NW	.0102[b]	2.04	.0159[b]	2.26	.0085[b]	2.07	.0108	0.80	.0547[a]	2.74
CCR	.0001[c]	1.80	.0001[a]	2.62	.0002[a]	3.59	.0003[a]	4.54	.0005[a]	5.16
Spread	.0002[b]	2.04	.0003[b]	2.16	.0003[c]	1.80	.0003	1.11	−.0018[a]	−4.39
Y/Co	Yes		Yes		Yes		Yes		Yes	
Adj-R^2	0.37%		0.87%		2.11%		4.87%		10.11%	
No. of obs.	38,282		38,204		38,048		37,775		37,151	

The table presents the coefficient estimates of Eq. (2) using data samples of 'EU–CA' countries rated by Moody's, S&P and Fitch during October 2006–July 2010. $\Delta EX_{i,s}$ the dependent variable, is the change in the natural logarithm of the exchange rate of sovereign i per US$ in the following time windows around the credit event date t: [−1, +1], [−1, +3] [−1, +7], [−1, +14] and [−1, +30]. UP_{it} (DN_t) takes the value of 1 if sovereign i is upgraded (downgraded) at time t, zero otherwise. PO_{it} (NO_{it}) takes the value of 1 if sovereign i experiences a *positive* (*negative*) *outlook* action at time t, zero otherwise. PW_{it} (NW_{it}) takes the value of 1 if sovereign i experiences a *positive* (*negative*) *watch* action at time t, zero otherwise. Due to currency appreciation/depreciation, a negative (positive) coefficient is expected for positive (negative) signals. CCR the level of event country comprehensive credit rating. Spread the spread between yields on Moody's Baa and Aaa corporate bonds in the US. Full sets of year and country dummies are included. We apply Huber–White robust standard errors.

[a] Significant at 1% level.
[b] Significant at 5% level.
[c] Significant at 10% level.

Disentangling the effects of various types of sovereign credit signals during the crisis period in Table 5, we show that watch and outlook signals are the sources where the CRAs reveal more new information. This is unsurprising, given that more than 80% of actual rating changes in this sample are preceded by outlook or watch signals (see Table 1, Row 23). The effect of Moody's positive news reported in Table 4 is shown to be linked to positive outlook and watch announcements only, not upgrades. The immediate impact of Moody's negative watch signals (1.77%) is stronger than that of Moody's downgrades (1.62%). Also, S&P negative watch (outlook) signals are associated with currency depreciations by 1.32% (0.50%), 1.70% (0.65%), 2.42% (0.66%), 2.02% (0.97%), and 2.52% in the five event windows. However, S&P downgrades have an insignificant impact. Fitch negative watch events are associated with stronger effects than are downgrades. The currency depreciations following Fitch watch announcements are 1.02%, 1.59%, 0.85%, 5.47% in the [−1, +1], [−1, +3], [−1, +7] and [−1, +30] windows, compared to 0.77%, 0.29% and 0.71% in the [−1, +1], [−1, +3], [−1, +7] windows for downgrades. The crisis period results strongly support Hypothesis $H1_0$. Interestingly, significant reactions to negative outlook signals are demonstrated for S&P

only during the crisis period, possibly because of the higher number of negative outlook actions by S&P compared to Moody's and Fitch (see Row 10 of Table 1).

Importantly, in Tables 4 and 5, the comprehensive credit rating (CCR) is positive and significant in all but one case. This implies that the higher the credit quality of the sovereign, the stronger the effect of signals during the crisis period. This is mainly driven by the downgrade pressure facing many governments in the euro area. This is the opposite to the finding for the pre-crisis period, but is intuitively expected given the substantial increase in the number of sovereign credit signals related to investment-grade rated sovereigns and euro-zone sovereigns during the crisis period compared to pre-crisis (see Table 1, Rows 20 and 21). In general, it is evident that the effects of sovereign credit signals are far stronger during the crisis period compared to previously. The US spread variable demonstrates mixed evidence, and is probably dominated by the other effects in most cases.

6.2. Spillover effects of sovereign credit news

6.2.1. Pre-crisis period

This section analyses the spillover effects of sovereign credit news based on estimation of Eqs. (3) and (4) during the pre-crisis period. The results for Eq. (3) are reported in Table 6. There is relatively limited evidence of spillover effects during this period. Positive news by all agencies is associated with insignificant spillover effects. Only negative actions by S&P indicate immediate significant spillover effects on the exchange rates of non-event countries. A 1% decrease in the LCCR of the event country by S&P is associated with a 1.50% currency depreciation for non-event countries in the [−1, +1] event window. Negative news by S&P and Fitch has a significant effect on non-event countries' exchange rates in the [−1, +14] and [−1, +30] event windows, and S&P actions illustrate the stronger effect (7.00% versus 1.15% and 3.20% versus 2.80%).[18] A 1% decrease in LCCR of the event country by Fitch is associated with a 0.92% currency depreciation in non-event countries in the [−1, +7] event window.

Interestingly, the level of event country comprehensive credit rating is mostly significant with a negative sign for negative events. This suggests that the lower the event country CCR, the greater the non-event country exchange rate response in these cases. Hence, the spillover effect of negative sovereign credit signals is most marked for lower-quality sovereign issuers in the pre-crisis period.

In the second element of analysis, we distinguish between the spillover effects of different types of credit signals across CRAs (Eq. (4)). The results are consistent with Table 6.[19] All types of Moody's actions have insignificant spillover effects on the exchange rate. In addition, negative events by the S&P and Fitch significantly spillover to non-event countries. However, the non-event countries' exchange rates react more strongly to negative outlook and negative watch signals by S&P and Fitch than to downgrades. The results in this section support Hypothesis $H2_0$.

6.2.2. Crisis period

This section analyses the spillover effects of credit events based on estimation of Eqs. (3) and (4) during the crisis period. The results for Eq. (3) are reported in Table 7. It is evident that the spillover effects of signals are much stronger during the crisis period compared to pre-crisis. Positive news from Moody's only has a significant effect on the currencies of other countries. A 1% increase in the LCCR of the event country by Moody's is associated with 2.16%, 3.82%, 8.18%, 8.25%, and 8.10% currency appreciations in non-event countries in the five event windows. Negative news from each CRA leads to strong contagion in all event windows during the crisis period. Fitch events tend to demonstrate the strongest effect. The immediate spillover effect of Fitch negative signals to other countries' exchange rates (3.27%) is about double that of Moody's (1.47%) and S&P (1.90%). The currency depreciations in the non-event countries following Fitch negative signals are 1.69%, 4.03%, 3.87% and 10.11% in the four longer event windows, while the equivalent figures for S&P (Moody's) are 1.66% (2.66%), 2.37% (2.53%), 3.77% (2.41%) and 3.41% (9.09%). Overall, the results strongly support Hypothesis $H2_0$.

A potential explanation for the stronger reaction to Fitch signals (see also Section 6.1.2) and its stronger spillover effects during the crisis period is that there could be a cumulative effect as confirmatory signals are provided by second and third CRAs following the news released by a 'first mover' on a given sovereign rating. Alsakka and ap Gwilym (2010) find that Fitch rating actions tend to follow those of Moody's and S&P, and therefore the market may respond immediately and strongly to Fitch signals that confirm prior news from one or both of the other two CRAs. Each of the three CRAs independently produces signals at different times, and each CRA's signal can contain information. The direction of signals may be the same, but it does not mean that the CRAs start and end by being in agreement on the rating (see Fig. 1). The apparent weight attached to Fitch signals during the crisis period could also be explained by Fitch being a European-owned agency (Moody's and S&P have US headquarters). Market participants may also pay close attention to Fitch signals because London has the largest share of foreign exchange turnover (36.7% according to BIS, 2010).

Importantly, the level of event country CCR is positive when significant for negative signals, implying that the higher the event country CCR, the stronger the non-event countries' exchange rate reactions for negative events. This suggests that the

[18] This seemingly delayed reaction is somewhat consistent with Brooks et al.'s (2004) finding that the foreign exchange market can take up to 20 days to digest negative sovereign credit news.

[19] The results table is not presented here in the interests of brevity, but is available on request.

Table 6
Spillover effects in the 'EU–CA' region during the pre-crisis period.

	Positive signals						Negative signals					
	Moody's		S&P		Fitch		Moody's		S&P		Fitch	
	Coeff	*t*-Val	Coeff	*t*-Val	Coeff	*t*-Val	Coeff	*t*-Val	Coeff	*t*-Val	Coeff	*t*-Val
[−1, +1]												
Constant	−.0300[a]	−4.70	.0200[c]	1.91	.0056	0.91	−.0434[c]	−1.93	−.0336[a]	−4.19	.0787[a]	5.66
ΔLCCR	−.0039	−1.50	−.0004	−0.67	.0014	0.49	.0118	1.06	.0150[b]	2.13	.0009	0.73
CCR ev	.0005[a]	4.21	−.0004[a]	−2.76	−.0001[a]	−4.07	−.0014[c]	−1.88	.0001	0.34	−.0002	−1.31
CCR n-e	−.0001	0.02	−.0001	−1.42	−.0003[a]	−3.26	−.0001	−0.61	.0001	0.67	−.0003[a]	−4.25
Spread	.0080[a]	3.79	.0001	0.04	.0104[a]	3.24	−.0717[c]	−1.89	−.0395[a]	−4.74	−.0725[a]	−5.74
Y/Co	Yes		Yes		Yes		Yes		Yes		Yes	
Adj-R^2	13.0%		15.23%		11.2%		23.8%		29.7%		48.5%	
Obs.	1260		1609		1705		147		515		495	
[−1, +3]												
Constant	−.0480[a]	−5.17	−.0267[b]	−2.23	.0114	1.50	.1057[b]	2.19	−.0043	−0.34	.0807[a]	4.18
ΔLCCR	−.0178	−1.46	−.0015	−1.08	−.0007	−0.96	.0025	0.22	.0107	1.04	.0019	0.99
CCR ev	.0011[a]	5.67	.0001	0.27	−.0001[a]	−4.45	−.0001	−0.11	.0004	1.38	−.0002	−1.01
CCR n-e	.0001[b]	1.98	−.0001	−0.77	−.0004[a]	−3.51	−.0001	−0.51	−.0001	−0.26	−.0001	−1.35
Spread	.0221[a]	7.31	.0070[b]	2.18	.0122[a]	2.81	−.1089	−1.40	−.0027	−0.23	−.0803[a]	−4.70
Y/Co	Yes		Yes		Yes		Yes		Yes		Yes	
Adj-R^2	27.4%		21.1%		8.9%		48.9%		34.1%		47.6%	
Obs.	1260		1609		1705		147		515		495	
[−1, +7]												
Constant	−.1211[a]	−8.43	−.0219	−1.35	.0096	1.00	−.0471	−0.83	−.0610[a]	−3.23	−.0269	−1.00
ΔLCCR	−.0195	−1.62	−.0066	−0.79	.0007	0.58	.0482	1.02	.0034	0.26	.0092[a]	2.82
CCR ev	.0021[a]	7.47	.0001	0.91	−.0002[a]	−5.93	−.0069[a]	−4.29	−.0015[a]	−3.60	.0001	0.03
CCR n-e	.0002	1.55	−.0001	−0.36	−.0004[a]	−2.76	−.0004	−1.20	−.0001	−0.79	−.0003[b]	−2.04
Spread	.0433[a]	12.23	.0018	0.47	.0207[a]	4.13	−.1725[b]	−2.07	−.0405[b]	−2.30	−.0793[a]	−3.47
Y/Co	Yes		Yes		Yes		Yes		Yes		Yes	
Adj-R^2	23.9%		23.4%		11.5%		42.2%		42.6%		42.7%	
Obs.	1260		1609		1705		147		515		495	
[−1, +14]												
Constant	−.1367[a]	−6.70	−.0037	−0.13	.0173	1.41	−.1025	−0.89	−.1847[a]	−6.12	.1553[a]	4.22
ΔLCCR	−.0145	−1.36	−.0143	−1.45	−.0005	−0.33	.0571	1.59	.0700[a]	4.13	.0115[a]	2.96
CCR ev	.0022[a]	5.25	.0001	0.04	−.0002[a]	−4.76	−.0081[b]	−2.09	−.0021[a]	−3.30	.0002	0.76
CCR n-e	.0001	0.78	.0001	0.56	−.0006[a]	−3.31	−.0014[b]	−2.16	−.0003	−1.00	−.0008[a]	−3.14
Spread	.0339[a]	6.34	.0221[a]	3.65	.0254[a]	3.61	.2314	1.20	−.1782[a]	−5.70	−.1503[a]	−5.13
Y/Co	Yes		Yes		Yes		Yes		Yes		Yes	
Adj-R^2	27.7%		22.7%		9.2%		43.9%		35.8%		38.2%	
Obs.	1260		826		1705		147		515		495	
[−1, +30]												
Constant	−.0551[c]	−1.92	.0693[c]	1.84	−.0211	−0.91	−.1887	−1.17	−.0829[b]	−2.21	−.0211	−0.32
ΔLCCR	−.0062	−0.99	−.0154	−1.61	.0050	0.80	.0488	1.23	.0320[a]	4.55	.0280[a]	4.31
CCR ev	.0062	0.22	−.0004	−0.95	−.0001[b]	−2.32	−.0071	−1.33	−.0026[b]	−2.48	−.005 9[a]	−8.01
CCR n-e	−.0002	−0.68	−.0005[c]	−1.87	−.0010[a]	−2.87	−.0008	−0.87	−.0004	−1.16	−.0010[b]	−2.62
Spread	.0428[a]	5.18	.0427[a]	4.84	.0911[a]	9.39	.3037	1.14	.0435	1.20	−.3555[a]	−6.26
Y/Co	Yes		Yes		Yes		Yes		Yes		Yes	
Adj-R^2	24.3%		21.8%		13.03%		27.3%		33.6%		44.5%	
Obs.	1260		1609		1705		147		515		495	

The table presents the coefficient estimates of Eq. (3) using a sample of sovereign credit events only by Moody's, S&P and Fitch during September 2000–September 2006. $\Delta EX_{j,s}$ change in the natural logarithm of the US$ exchange rate of non-event country *j* in the [−1, +1], [−1, +3] [−1, +7], [−1, +14] and [−1, +30] time windows. $\Delta LCCR_{it}$ 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 (ev) and non event (n-e) country comprehensive credit rating. Spread the spread between yields on Moody's Baa and Aaa corporate bonds in the US. Year, event country and non-event country dummies are included. We apply Huber–White robust standard errors.

[a] Significant at 1% level.
[b] Significant at 5% level.
[c] Significant at 10% level.

impact of negative news is most marked for higher credit quality countries during the crisis period. This is contrary to the evidence in the pre-crisis period (see Section 6.2.1), but is intuitively expected (see Table 1, Rows 20 and 21). Moreover, for Moody's positive signals, the level of event country CCR is negative when significant, implying that the impact of Moody's positive news is most marked for lower credit quality sovereigns during the crisis period.

Table 8 reports estimates of the coefficients of Eq. (4) to disentangle the spillover effects of various types of signals during the crisis period. Positive news from Moody's only significantly spills over to non-event countries, but the effect is shown to

Table 7
Spillover effects in the 'EU–CA' region during the crisis period.

	Positive signals						Negative signals					
	Moody's		S&P		Fitch		Moody's		S&P		Fitch	
	Coeff	*t*-Val	Coeff	*t*-Val	Coeff	*t*-Val	Coeff	*t*-Val	Coeff	*t*-Val	Coeff	*t*-Val
[−1, +1]												
Constant	.0115[a]	6.07	.0180[a]	2.82	.0435[a]	3.23	−.0138	−0.95	−.0382[a]	−5.02	−.0703[a]	−3.27
ΔLCCR	−.0216[c]	−1.80	−.0336	−1.54	−.0002	−0.04	.0147[a]	5.81	.0190[a]	4.24	.0327[a]	7.32
CCR ev	−.0001[c]	1.73	−.0004[b]	−2.08	−.0008[a]	−4.44	−.0001	−0.97	.0005[b]	2.36	.0004[b]	2.27
CCR n-e	−.0001	1.08	.0001	0.62	0.0001	0.02	.0004[b]	2.13	.0003[c]	1.92	0.0001	0.03
Spread	−.0128[a]	−8.76	−.0013	−1.20	−.0041	−2.02	.0009	1.15	.0007	1.05	.0010	1.37
Y/Co	Yes		Yes		Yes		Yes		Yes		Yes	
Adj-R^2	28.2%		35.4%		47.2%		28.3%		18.4%		23.7%	
Obs.	478		878		653		1162		1854		1337	
[−1, +3]												
Constant	.0040[b]	2.02	.1276[a]	6.34	−.0090	−0.56	−.0969[a]	−3.21	−.0161[c]	−1.66	−.0260	−0.75
ΔLCCR	−.0382[a]	−2.98	−.0172	−1.08	.0017	0.19	.0266[a]	8.10	.0166[a]	3.65	.0169[b]	2.36
CCR ev	−.0002[a]	−2.67	−.0025[a]	−6.37	.0002	1.09	.0003[b]	2.35	.0007[b]	2.50	.0005[c]	1.99
CCR n-e	.0001	1.30	.0002	0.89	.0001	0.41	.0013[a]	2.79	.0006[a]	2.66	.0003[b]	1.98
Spread	−.0090[a]	−6.03	−.0044[b]	−2.28	−.0087[a]	−3.13	−.003[a]	−2.84	.0001	0.11	−.0012	−1.16
Y/Co	Yes		Yes		Yes		Yes		Yes		Yes	
Adj-R^2	17.2%		37.2%		43.0%		35.9%		16.5%		22.3%	
Obs.	478		852		653		1138		1854		1337	
[−1, +7]												
Constant	.0242[a]	7.23	.3010[a]	8.17	−.0364	−1.62	−.2590[a]	−3.43	−.1303[a]	−4.80	−.0394[a]	−2.85
ΔLCCR	−.0818[a]	−4.20	−.0135	−0.87	−.0547	−0.67	.0253[a]	4.44	.0237[a]	3.95	.0403[a]	3.91
CCR ev	.0001	1.61	−.0066[a]	−8.09	−.0008[a]	−2.78	.0013[a]	4.11	.0010[a]	2.95	−.0003	−0.99
CCR n-e	.0001[c]	1.79	.0007	1.43	.0001	0.50	.0023[c]	1.86	.0010[a]	2.81	−.0001	−0.20
Spread	−.0233[a]	−8.58	−.0083[a]	−3.28	.0007	0.19	−.0042[c]	−1.90	−.0011	−0.93	−.0004	−0.36
Y/Co	Yes		Yes		Yes		Yes		Yes		Yes	
Adj-R^2	38.3%		46.4%		31.2%		33.3%		20.9%		36.0%	
Obs.	478		826		653		1115		1829		1336	
[−1, +14]												
Constant	.0111[b]	2.48	.1878[a]	3.83	−.0601[a]	−4.48	−.1674[a]	−3.08	.0148	0.85	−.0417[a]	−2.80
ΔLCCR	−.0825[a]	−2.65	−.0175	−0.84	−.0933	−1.53	.0241[a]	2.67	.0377[a]	5.11	.0387[a]	3.01
CCR ev	.0001	0.07	−.0041[a]	−3.98	−.0024[a]	−5.07	.0021[a]	5.33	.0009	1.60	.0026[a]	5.30
CCR n-e	.0001[b]	1.97	.0006	1.27	.0004	0.95	.002b[a]	2.36	.0004	1.02	−.0003	−0.67
Spread	−.0196[a]	−5.61	−.0048	−1.34	−.0018	−0.36	−.0066[a]	−2.60	−.0007	−0.47	.0001	0.08
Y/Co	Yes		Yes		Yes		Yes		Yes		Yes	
Adj-R^2	35.3%		41.8%		44.4%		30.7%		22.7%		39.3%	
Obs.	478		826		629		1067		1803		1336	
[−1, +30]												
Constant	.0052[c]	1.74	.6101[a]	8.20	.1683[a]	3.45	−.2577[a]	−2.87	−.0534[b]	−2.04	.1228[a]	4.52
ΔLCCR	−.0810[a]	−6.52	.0205	0.77	−.3034[b]	−2.06	.0909[a]	6.28	.0341[a]	2.86	.1011[a]	5.47
CCR ev	−.0009[a]	−3.40	−.0144[a]	−9.92	−.0041[a]	−6.07	.0002	0.38	.0004	0.65	.0018[a]	5.51
CCR n-e	.0005[a]	5.24	.0009	1.38	.0007	1.38	.0029[b]	1.97	.0013[b]	1.99	.0011	1.26
Spread	−.0442[a]	−7.56	.0003	0.06	−.0262[a]	−4.33	−.0140[a]	−4.07	.0023	1.09	−.0128[a]	−4.62
Y/Co	Yes		Yes		Yes		Yes		Yes		Yes	
Adj-R^2	51.3%		50.8%		54.2%		32.7%		28.4%		37.5%	
Obs.	478		826		606		1043		1803		1335	

The table presents the coefficient estimates of Eq. (3) using a sample of sovereign credit events only by Moody's, S&P and Fitch during October 2006–July 2010. $\Delta EX_{j,s}$ change in the natural logarithm of the US$ exchange rate of non-event country *j* in the [−1, +1], [−1, +3] [−1, +7], [−1, +14] and [−1, +30] time windows. $\Delta LCCR_{it}$ 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 (ev) and non event (n-e) country comprehensive credit rating. Spread the spread between yields on Moody's Baa and Aaa corporate bonds in the US. Year, event country and non-event country dummies are included. We apply Huber–White robust standard errors.

[a] Significant at 1% level.
[b] Significant at 5% level.
[c] Significant at 10% level.

be linked to positive outlook and/or watch announcements, not upgrades.[20] Negative news from each CRA has a significant effect on other currencies, but the strongest reactions are found in response to outlook and watch signals rather than rating

[20] Moody's upgrades have a significant spillover effect (0.39%) on the foreign exchange market in the [−1, +3] event window, but this is weaker than the spillover effect of Moody's positive outlook and watch signals (0.71% and 3.36%). In the [−1, +30] event window, upgrades and positive outlook and watch signals by S&P are associated with a significant spillover effect.

Table 8
Spillover effects in the 'EU–CA' region during the crisis period – various signal types.

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	−.0167[c]	−1.82	−.0048	−1.25	−.0515	−1.36	.0039	0.48	−.0637	−1.44
UP	−.0004	−0.30	−.0039[c]	−1.81	.0003	0.13	.0028	0.79	−.0054	−0.54
PO	−.0059[c]	−4.82	−.0071[a]	−5.44	−.0114[a]	−4.30	−.0013	−0.36	−.0143[a]	−3.11
PW	−.0036	−1.58	−.0336[b]	−2.38	−.0266[a]	−5.83	−.0350[a]	−6.70	−.0442[a]	−8.11
DN	.0035[a]	4.15	.0022[b]	1.87	.0068[a]	3.02	.0046	1.55	.0108[a]	2.64
NO	.0007	0.55	.0061	0.83	.0001	0.07	.0030	0.87	.0107[b]	2.35
NW	.0074[a]	4.77	.0116[a]	6.98	.0184[a]	6.23	.0289[a]	6.44	.0279[a]	4.90
CCR ev	−.0001[a]	−3.04	−.0002[a]	−4.65	−.0005[a]	−5.60	−.0004[a]	−3.53	−.0006[a]	−3.95
CCR n-e	.0003[c]	1.92	.0008[a]	2.69	.0012[c]	1.79	.0015[a]	3.10	.0024[a]	3.21
Spread	−.0022[a]	−3.88	−.0045[a]	−4.22	−.0081[a]	−4.53	−.0088[a]	−4.44	−.0208[a]	−7.17
Y/Co	Yes		Yes		Yes		Yes		Yes	
Adj-R^2	11.89%		9.88%		14.03%		15.82%		21.80%	
No. of obs.	1639		1615		1592		1544		1520	
Panel II – S&P										
Constant	−.0080[c]	−1.92	−.0380[a]	−3.34	−0.0082	−0.56	.0129	0.75	.0146	0.41
UP	.0018	1.54	.0003	0.19	−.0005	−0.23	−.0027	−0.90	−.0270[a]	−6.43
PO	−.0013	−0.96	−.0022	−1.18	−.0001	−0.35	.0029	0.79	−.0110[b]	−2.16
PW	−.0016	−1.29	−.0026	−1.55	−.0002	−0.07	.0030	0.86	−.0116[b]	−2.52
DN	.0057[a]	6.04	.0020	1.56	.0054[a]	2.93	.0092[a]	3.98	.0045	1.36
NO	−.0028	−1.53	.0101[b]	2.12	.0840[a]	6.77	.0916[a]	7.90	.1368[a]	8.19
NW	.0111[a]	7.52	.0108[a]	5.24	.0184[a]	6.47	.0207[a]	4.97	.0099[c]	1.69
CCR ev	.0001	0.71	.0002	0.55	.0001[c]	1.88	.0004[a]	6.09	.0006[a]	4.96
CCR n-e	.0004[a]	2.72	.0006[a]	3.16	.0010[a]	3.27	.0004	1.18	.0010[b]	2.11
Spread	.0003	0.52	−.0016[b]	−2.21	−.0030[a]	−2.76	−.0015	−1.12	−.0016	−0.91
Y/Co	Yes		Yes		Yes		Yes		Yes	
Adj-R^2	11.91%		8.45%		12.87%		13.85%		15.96%	
No. of obs.	2732		2706		2655		2629		2629	
Panel III – Fitch										
Constant	−.0150[a]	−4.05	−.0239[a]	−4.34	.0079	1.10	.0018	0.22	.0100[a]	6.01
Up	.0027	0.98	.0008	0.22	−.0042	−1.20	.0038	0.81	−.0298	0.16
PO	.0001	0.02	−.0018	−1.21	.0001	0.04	.0006	0.21	−.0033	−0.19
PW	.0013	0.44	−.0001	−0.01	.0047	1.27	.0018	0.16	.0467	0.93
DN	.0040[c]	1.72	.0053[c]	1.81	−.0024	−0.88	.0099[b]	2.87	.0035[a]	4.00
NO	−.0013	−0.47	.0049	1.38	.0015	0.38	.0095	1.61	.0098	0.96
NW	.0113[a]	8.53	.0083[a]	4.56	.0090[a]	5.06	.0184[a]	6.35	.0085[a]	1.80
CCR ev	.0006[a]	4.67	.0011[a]	5.96	−.0004[a]	−4.91	−.0011[a]	−3.05	−.0025[a]	−4.40
CCR n-e	.0001	0.21	−.0002	−0.87	−.0001	−0.45	−.0002[a]	−3.69	−.0003	−0.04
Spread	.0009	1.29	−.0001	−0.01	−.0015	−1.43	−.0017	−1.05	−.0139[a]	−4.69
Y/Co	Yes		Yes		Yes		Yes		Yes	
Adj-R^2	18.12%		19.60%		19.61%		25.04%		28.76%	
No. of obs.	1990		1990		1989		1965		1941	

The table presents the coefficient estimates of Eq. (4) using a sample of sovereign credit events only by Moody's, S&P and Fitch during October 2006–July 2010. $\Delta EX_{j,s}$ change in the natural logarithm of the US$ exchange rate of non-event country *j* in the [−1, +1], [−1, +3] [−1, +7], [−1, +14] and [−1, +30] time windows. UP_{it} (DN_{it}); PO_{it} (NO_{it}); and/or PW_{it} (NW_{it}) are dummy variables taking the value of 1 if event sovereign *i* experiences a rating upgrade (downgrade); positive (negative) outlook signal; and/or positive (negative) watch action at event date *t*, zero otherwise. CCR the level of event (ev) and non event (n-e) country comprehensive credit rating. Spread the spread between yields on Moody's Baa and Aaa corporate bonds in the US. Year, event country and non-event country dummies are included. We apply Huber–White robust standard errors.

[a] Significant at 1% level.
[b] Significant at 5% level.
[c] Significant at 10% level.

changes. The spillover impact of Moody's negative watch signals (0.74%, 1.16%, 1.84% and 2.79%) is more than double that for Moody's downgrades (0.35%, 0.22%, 0.68% and 1.08%) in the three shortest event windows and the [−1, +30] window. S&P negative watch (outlook) signals are associated with depreciations in other currencies by 1.11%, 1.08% (1.01%), 1.84% (8.40%), 2.07% (9.16%) and 0.99% (13.68%) in the five event windows. It is clear that S&P offers uniquely informative negative outlook signals. However, S&P downgrades have significant, but weaker, spillover effects (0.57%, 0.54%, and 0.92%) in the [−1, +1], [−1, +7] and [−1, +14] event windows. Fitch negative watch events are associated with considerably stronger spillover effects than their downgrades. Depreciations in other currencies following Fitch watch signals (downgrades) for a given sovereign are 1.13% (0.40%), 0.83% (0.53%), 0.90% (not significant), 1.84% (0.99%) and 0.85% (0.35%) in the five event windows. Overall, the stronger effects of outlook and watch signals are consistent with Hypothesis $H2_0$.

7. Conclusion

During 2010–2011, concerns in global financial markets have been dominated by the European sovereign debt crisis. Also, the reform of the credit rating industry has been high on the agenda of policymakers and regulators in developed economies. We address both of these topical issues by examining how the foreign exchange spot market reacts to sovereign credit events in the Europe and Central Asia region prior to, and during this crisis. We also investigate the impact of a given sovereign credit signal on other currencies (i.e. spillover effects). We use daily observations of ratings, outlooks and watchlists of sovereigns which are rated by at least one of the three major CRAs during the pre-crisis period (September 2000 to September 2006), and the crisis period (October 2006 to July 2010). There is a downgrade trend in sovereign credit actions during the crisis period, whereas an upgrade trend existed previously. S&P tends to be the first mover in signalling negative news related to European countries and mostly assigns the lowest ratings during the crisis period. We find evidence of different practices applied by CRAs in adjusting ratings, outlook and watch status. S&P has more emphasis on short-term accuracy, while Moody's actions are consistent with greater stability.

The results show that sovereign credit signals do have an impact on the foreign exchange market, yet there are differing reactions to the news from the three CRAs. Importantly, the strongest market reactions are in response to outlook and watch announcements rather than rating changes. It is evident that the effects of sovereign credit events on exchange rates are far stronger during the crisis period compared to previously. During the crisis period, negative news from the three CRAs affects the own-country exchange rates and contributes to contagion. Fitch negative signals demonstrate the strongest reactions and S&P offers uniquely informative negative outlook signals, while Moody's demonstrates an information lead for positive news. During the pre-crisis period, negative news by S&P and Fitch shows a weaker impact on markets. The exchange rates of higher-rated countries are more influenced by negative sovereign credit events during the crisis period, while rates of lower-rated countries are more influenced in the pre-crisis period.

The fact that CRA news induces a market reaction, and that such news has a stronger impact in the crisis period leads to the question of whether the CRAs' actions worsened the crisis. This view was expressed by many European politicians and commentators. Their concern is partly justified, since CRA actions have increased the pressure on the euro, and increased borrowing costs for already highly indebted economies. However, there is an element of failure to confront the underlying economic problems and of 'shooting the messenger' (see House of Lords, 2011). If CRAs make erroneous judgements on sovereign creditworthiness or if they frequently reverse their judgements, there would seem to be a case to answer, but neither of these issues appears to be relevant during the 2006–2010 period.

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