Realizing the impacts of sovereign ratings on stock and currency markets

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Abstract

This study examines the asymmetric effects of different types of sovereign rating announcements on realized stock and currency market volatility, skewness and correlations around periods of financial crises. Using intraday market data and historical sovereign ratings data from Standard and Poors for sample countries in the Asia-Pacific region over 1997-2001, we find that currency and stock markets react heterogeneously to ratings announcements and that stock markets are more responsive to rating news than currency markets. We find clear evidence that ratings events have significant and asymmetric impacts on higher moments of both asset market returns.

JEL: G15, F30, F31

Keywords: realized volatility, skewness, realized correlations, currencies, stocks, ratings, emerging markets

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1. Introduction

Credit rating agencies are entrusted as specialist information providers in international financial markets and should in theory facilitate the efficient operation of financial markets. Yet, the informational value of ratings and the role of rating agencies in the international financial system remains widely debated. In particular, the development of the Asian Financial Crisis (AFC) in the past decade raises some outstanding research questions. Does news on sovereign debt ratings impact on currency markets? What about its relation to stock markets? Do sovereign ratings have significant impacts on the higher moments of asset returns? As significant financial losses resulted from drastic declines in currency values and stock prices during the AFC, these questions need to be addressed before the next currency crisis erupts.

This papers aims to examine the effect of announcements on sovereign credit rating and outlook changes on the realised second and third moments of stock returns and foreign exchange rates for sample countries in the Asia-pacific region. As credit rating agencies have often been criticised for being slow to react in international debt crises (see Mora (2006)), it is important to assess the wider impacts of rating agencies' guidance on the stability of stock and currency markets, as measured by higher moments of realized return distributions. In particular, we focus on the impacts over the period from 1997 to 2001, covering recent episodes of financial crises arising from East Asia (1997), Russia (1998) and other parts of the world.

Sovereign credit ratings provide publicly available information on a national government's ability and willingness to service its debts in full and in a timely manner and are primarily determined by a country's economic fundamentals (see Afonso (2003) and Cantor and

Packer (1996)). To date, the full extent of the impacts of agency ratings in the financial system remains not well understood. This paper complements existing studies and makes a significant contribution to the academic literature on rating impacts in international financial markets. Whilst the significant impacts of sovereign credit ratings on stock and debt market returns are established in the ratings literature (see Cantor and Packer (1996), Reisen and Von Maltzan (1999), Kaminsky and Schmukler (1999, 2002), Brooks et al. (2004), Gande and Parsely (2005), Ferreira and Gama (2007) and Pukthuanthong-Le et al. (2007)), the effects on higher moment asset returns; currency markets; and the joint effects on currency and stock markets have never been explicitly examined. As the asymmetric effects of ratings are established in the extant literature in that rating downgrades have bigger market impacts than upgrades (Reisen and Von Maltzan (1999), Brooks et al. (2004), Gande and Parsely (2005), Ferreira and Gama (2007)), it is only natural to examine whether there are also asymmetries in the rating impacts on higher moment stock and currency market returns.

The existing studies on rating impacts predominantly use the event study methodology and they examine the cumulative abnormal returns of stock markets in a time window of several days after a rating announcement to determine the impact of rating changes (see for example, Brooks et al (2004) and Ferreira and Gama (2007)). Instead, we propose a more flexible methodology for capturing a country's own rating impacts and its spill-over effects on other countries by using high frequency currency and stock market data to compute realized volatilities, skewness and realized cross-market correlations. The differential impacts on currencies and stock markets in the Asia-pacific during the AFC presents a good natural experiment for ascertaining the impact of sovereign ratings events on these higher moment return measures.

Our study also relates to the literature on the linkages between stock and currency returns, raised by the events of the Asian Financial Crisis. Phylaktis and Ravazzolo (2005) employ cointegration techniques to model short- and long-run dynamic relationships between monthly stock prices and exchange rates in the Pacific Basin region. Cumperayot et al. (2006) focus on modelling linkages between extreme stock market declines and currency depreciations using daily data. Kallberg et al. (2005) model structural breaks in the relations between currency and equity returns and volatility to find that market linkages strengthened post-breaks during the AFC. Our study complements this literature by focusing on the impact of sovereign ratings on contemporaneous realized correlations between stock and currency markets in the Asia-pacific region computed from intradaily data. News on sovereign debt ratings may affect stock-FX correlations. Ratings information provide signals on future economic conditions within the rated country and a downgrade may cause the national government to implement policies which reduce companies' future cashflows (eg., raising corporate taxes to service increased costs of debt) and affect stock markets as well as creating a general loss of investor confidence and rapid selling of the currency.

We find that currency (FX) and stock markets react heterogeneously to ratings announcements with stock markets being more responsive to rating news than currency markets. Changes on sovereign credit outlooks have more significant impact on realized volatility and skewness measures in stock markets but actual rating changes are more important in FX markets. We also find clear evidence that rating events have significant and asymmetric impacts on higher moments of both asset market returns with the exception that realized volatilities in stock markets increase with both rating upgrades and downgrade phases. Realized skewness increases with

downgrades and declines with upgrades and realized stock-FX correlations increase with downgrades and decreases with upgrades. The AFC only increased the sensitivity of realized volatilities to ratings information. Finally, there were marginal rating spillover effects from Korea on other markets' realized measures.

The contributions of our paper are as follows. First, to the best of the authors' knowledge, this is the first study to apply intraday financial market data to investigate the impact of sovereign credit ratings. The advantages of using daily measures computed from intradaily data over day to day closing prices is that they provide a better representation and more robust estimate of actual price behaviour. Daily close-to-close measures are unable to capture the intraday price fluctuations, which can be substantial particularly during times of financial distress. Second, we empirically investigate the impacts of sovereign credit ratings and its spill-over effects on FX markets for the first time. Finally, we shed new light on the impact of sovereign ratings on higher moments of asset returns as well as on cross-stock-FX market correlations.

Overall, this research has serious implications in light of the increased role of sovereign credit ratings under the new Basle II banking regulatory framework. A clearer understanding of rating impacts on stock and currency markets will not only be beneficial for risk management by corporate treasurers, portfolio investors and financial institutions managers but also system stability management by policymakers.

The organization of this paper is as follows. In section 2, we provide the data description followed by the empirical modelling in Section 3. In Section 4 we discuss our findings before concluding in Section 5.

2. Data description

The dataset obtained in this study consists of the bid-ask quote prices for both currencies traded and stock market indexes in five countries in the Asia-pacific region – namely, Australia, HK, Japan, Korea and Singapore. These are the only countries in the Asia-pacific region for which both stock and currency data are available at the intradaily frequency.[1] The intradaily tick by tick stock market data are captured from the Reuters' terminal and provided by SIRCA (Securities Industry Research Centre of Asia) in their TACTIQ database whilst the currency market quotes are directly sourced from Olsen associates (an international foreign exchange brokering firm). The five major currencies examined are the Australian dollar, Hong Kong Dollar, Korean Won, Japanese Yen and Singapore dollar against the US dollar and the stock market indices are the ASX100 (Australia), Hang Seng Index (Hong Kong), Nikkei (Japan), KOSPI200 (Korea), and Strait Times Index (Singapore) denominated in local currencies.

In addition, we use the history of foreign currency sovereign credit ratings and credit outlooks and watches from Standard and Poors.[2] As the timing of ratings announcements are not consistent[3], we focus on daily impacts of ratings announcements. Following the approaches of Gande and Parseley (2005) and Ferreira

[1] Whilst data was available for Malaysia, it was excluded from our sample due to the implementation of its currency control during the Asian Financial crisis. Bank Negara Malaysia pegged the ringgit to the U.S. dollar in September 1998, fixing its exchange rate at 3.80 ringgits to the dollar value for almost seven years.

[2] We focus only on foreign currency sovereign ratings assessments provided by S&P as previous studies have found these exert the greatest impact on market returns and are less anticipated (see Reisen and von Maltzan (1999) and Brooks et al. (2004)).

[3] S&P ratings announcements are generally made local a.m. time but the exact time of the day is not consistent.

and Gama (2007), we linearly transform the actual ratings and outlook and credit watch guidances on imminent rating changes into a comprehensive credit rating (CCR) measure over time (see Table A.1 in the Appendix for details on this transformation). We define a 'rating event' as a non-zero change in this CCR series. There are a total of 18 rating events in our overall sample, with Korea and HK being the most actively re-rated countries and contributing 11 and 5 of those events respectively.

The sample period that we study is from 6/1/1997 to 31/8/2001. This is the longest sample period for which we have intradaily data from both stock and currency markets to compute realized volatilities, skewness and cross market correlations. The intraday return is calculated as the log difference of the midpoint at time *t* and midpoint at time *t-1*.[4] Following Andersen and Bollerslev (1998), we compared preliminary volatility and correlation plots from 5 minute, 15 minute, 30 minute and hourly intervals (see currency volatility signature plots shown in Figure 1). Based on this comparison, we proceeded to use the daily realized measures computed from 30 minute intervals for our empirical estimations as they appear to only stabilize from this sampling interval.[5]

<insert Figure 1>

Based on the works of Andersen and Bollerslev (1998), Barndorff-Nielsen & Shephard (2001) and Andersen et al. (2007), we argue that daily realized measures calculated based on intraday returns provides more consistent and efficient measures than those computed from close to close prices.

[4] We use the mid-point quote between the Bid and Ask price to minimize the effect of Bid-Ask bounce, as suggested by Roll (1984).

[5] For the preliminary test, we also analyse 5 minute and one hour intervals and results are similar to what reported in this paper.

Hence, the daily realized volatility is defined as follows:

$$RV_t = \sum_{d=1}^{D} r_{d,t}^2 \tag{1}$$

where $r_{d,t}$ denotes a *d*th 30-minute return during day *t* and *D* denotes the total number of 30-minute return intervals during any trading day. This is basically the sum of consecutive squared log price changes.

As in Hutson et al. (2008), we compute two alternative measures of skewness. The daily realized skewness for any day *t* is defined as follows:

$$SKW_t = -\frac{D(D-1)^{3/2}\left(\sum_{d=1}^{D} r_{d,t}^3\right)}{(D-1)(D-2)\left(\sum_{d=1}^{D} r_{d,t}^2\right)^{3/2}} \tag{2}$$

where $r_{d,t}$ denotes a *d*th 30-minute return during day *t* and *D* denotes the total number of 30-minute return during any trading day. This is the negative of the third moment of returns divided by the cubed standard deviation of returns to standardise for differences in variances.

The alternative "down-to-up-volatility" skewness measure is defined as follows:

$$DU_t = \log\left(\frac{(D_u - 1)\sum_{d=1}^{D_d} Rdown_{d,t}^2}{(D_d - 1)\sum_{d=1}^{D_u} Rup_{d,t}^2}\right) \tag{3}$$

where $Rdown_{d,t}$ denotes a *d*th 30-minute return during day *t* that is less than the average return for this particular day, $Rup_{d,t}$ denotes a *d*th 30-minute return during

day t that is greater than the average return for this particular day, and D_d and D_u are the daily totals of the corresponding returns. It should be noted that $D = D_d + D_u$. This is a log ratio of the standard deviations of returns below and above the mean return.

The daily realized correlation is defined as follows:

$$RCOR_t = \sum_{d=1}^{D} r_{d,j,t} r_{d,i,t} \tag{4}$$

where $r_{d,i,t}$ denotes a dth 30-minute return during day t for asset i, $r_{d,j,t}$ denotes a dth 30-minute return during day t for asset j, and D denotes the total number of 30-minute return during any trading day. Following Christiansen and Ranaldo's (2007) modelling of realized bond-stock correlation, we also perform a Fisher transformation to convert the [-1,1] bounded correlation measure to support the whole real line.

The basic descriptive statistics on our sample currency and stock markets are presented in Table 1. The descriptive statistics of the daily realized volatilities, skewness and cross-market correlations are given in Table 1. We find the Australian stock market index and the HKD to be the least volatile which makes intuitive sense given there is less trading volume in former and the latter is pegged at 7.8 HKD/USD. Moreover, the Singapore market index and the KRW are the most negatively skewed. Korea also has the lowest correlation between its stock market index and currency returns whereas Australia has the highest, perhaps due to the commodity influence in both markets. A strong serial correlation exists for daily realized series as the Ljung-Box Q-statistic rejects the null hypothesis of no autocorrelation up to lag twenty. The Augmented Dickey Fuller (ADF) test rejects the existence of a unit root in the time series of daily realized measures for both stock and FX markets at 1% significance

level. Hence, the time series of these daily realized measures can be analyzed in levels.

<insert Table 1>

3. Empirical modeling

To investigate the impacts of ratings announcements on realized volatilities, skewness and cross-market correlations for currency and stock returns, we utilise a framework similar to that adopted by Christiansen and Ranaldo (2007) for studying intraday news effects in the US stock and bond markets.

However, instead of using straight-forward dummy variables for capturing announcement effects during the trading day, we adopt the comprehensive credit rating "event" variables similar to those used in Gande and Parsely (2005) and Ferreira and Gama (2007) for studying rating spillover effects from other countries in international debt and stock markets respectively. In this way, we introduce a more flexible framework for investigating the impact of different types of ratings information on the day of release.

Rating events are defined as a non-zero change in the comprehensive credit rating series comprising actual credit ratings and credit outlooks and watches assigned to the country's sovereign debt. Both forms of ratings guidance are intended to be forward-looking measures of the perceived ability and willingness of sovereign debt issuers to service their financial obligation. However, actual rating changes reflect perceived permanent changes in credit quality in the long-term whereas credit outlooks and watches indicate imminent changes in ratings over the short-term.

Using pooled (panel) regression analysis, we estimate the following general model with fixed country and time effects:

$$Y_{i,t} = \alpha_i + \beta_1 Event_{i,t} + \beta_2 Event_{i,t-1} + \beta_3 CCR_{i,t} + \beta_4 CRISIS_t + \varepsilon_{i,t} \quad (5)$$

where $Y_{i,t}$ is the realised volatility; skewness or cross-currency-stock return correlation for country *i* on day *t*[6], $CCR_{i,t}$ is the country's ratings level, $Event_{i,t}$ is the change in the CCR measure and CRISIS is a time dummy for various periods of financial crises (Asian Financial crisis - AFC, Russian debt crisis - RFC and Global Financial crises which is the sum of the AFC, RFC as well as the Brazilian and Turkish financial crises (BFC and TFC) occurring during our sample period).[7,8] The main variable of interest is Event and the CCR variable controls for non-linearities in market reaction relative to the positive of each country on the rating scale.

This empirical framework is sufficiently flexible to allow the base model specification to be extended for additional tests on the market impacts of different types of ratings information – downgrades and upgrades; outlook and rating changes; and rating spillovers.

[6] As a robustness check, we also estimated the panel regressions for logarithmic forms of the dependent variables and the results were not qualitatively different. Following Christiansen and Ranaldo (2007), a Fisher transformation was first performed on the realized correlation series.

[7] The financial crises are dummy variables are defined as one on days during international financial crises and zero other wise based on dates in Kaminsky and Schmukler (2002) and Kaminsky et al. (2003).

[8] We also ran a dynamic panel data estimation with ΔY and Y_{t-1} but the model specification was not appropriate. Furthermore, we also included Y_{t-1} as an additional explanatory variable to account for serial correlation and used $\log Y_t$ as the dependent variable but the conclusions remain virtually unchanged and have been omitted for brevity.

First, to separately compare the impact of downgrade and upgrade phases in ratings, the following models were estimated:

$$Y_{i,t} = \alpha_i + \beta_1 Event_{i,t} + \beta_2 Event_{i,t-1} + \beta_3 CCR_{i,t} + \beta_4 CRISIS_t + \beta_5 I_t + \varepsilon_{i,t} \quad (6a)$$

$$Y_{i,t} = \alpha_i + \beta_1 Event_{i,t} + \beta_2 Event_{i,t-1} + \beta_3 CCR_{i,t} + \beta_4 CRISIS_t \times I_t + \varepsilon_{i,t} \quad (6b)$$

where I_t is an indicator variable for downgrades - DG (upgrades - UG) and takes a value of one in the period from a negative (positive) to positive (negative) Event and zero otherwise. The bulk of existing rating studies find that rating downgrades have more significant impact on market returns than upgrades (see for example, Brooks et al. (2004) and Creighton et al. (2007)).

Second, to identify the potential differential market reactions to outlook and rating changes, the following model was estimated:

$$Y_{i,t} = \alpha_i + \beta_1 CCR_{i,t} + \beta_2 CRISIS_t + \beta_3 Outch_t \times Event_t + \beta_4 Ratch_t \times Event_t + \varepsilon_{i,t} \quad (7)$$

where $Outch_t$ is a dummy variable defined as one when there is a change in sovereign outlook or credit watch and zero otherwise and $Ratch_t$ is similarly defined for actual ratings changes. Both of these variables are then interacted with the ratings Event variable to compare the separate impacts of outlook versus actual rating events.

Third, in the spirit of Gande and Parsley (2005) and Ferreira and Gama's (2007) ratings spillover studies, we also replace the ratings Event variable for country i with all other countries excluding i to determine the rating spillover effects to other sample countries' stock and currency markets in the Asia-pacific region. Hence, the following model specification was also estimated:

$$Y_{j,t} = \alpha_i + \beta_1 Event_{i,t} + \beta_2 Event_{i,t-1} + \beta_3 CCR_{i,t} + \beta_4 CCR_{j,t} + \beta_5 CRISIS_t + \varepsilon_{j,t} \forall j \notin i \quad (8)$$

4. Findings

We discuss the results first with respect to realized volatilities then realized skewness and cross-market correlations in stock and currency markets. Finally, we examine the rating spillover effects into other markets within the Asia-pacific region.

Rating impacts on realized volatility

Table 2 reports estimates of the panel regression models in Eq. (5-7) for realized stock and currency market volatility. We find evidence that ratings events within a country have significant impacts on stock market stability but not currency market stability. As one would expect, realized stock market volatility reacts negatively to the previous day's rating event but realized volatility in currency markets are not affected by rating news at all. However, consistent with rating impacts in other financial studies (Reisen and Von Maltzan (1999), Brooks et al. (2004), Gande and Parsely (2005), Ferreira and Gama (2007)) realized volatility in currency markets exhibits asymmetric responses and are more sensitive in phases following rating downgrades than upgrades. Stock market volatility reacts symmetrically to both upgrade and downgrade phases. This result is in contrast to existing findings of Brooks et al. (2004) based on stock market returns alone and points to equal information value of ratings upgrade as well as downgrade assessments in stock markets. In any case, our results imply that ratings information is impounded into stock returns more readily than into currency markets. Stock market participants appear to pay more attention to a country's sovereign ratings guidance than currency market participants. This may be explained by the fact that there are heterogeneous investors in the two asset markets with different trading motives. Ratings information may generate speculative trade in stock markets due to greater profit-taking motives.

<insert Table 2>

Realized volatility in both stock and currency markets were not only significantly and positively affected by the Asian financial crisis (AFC) but also the Russian debt crisis and global financial crises in general. Estimates for the interaction between the AFC and downgrade and upgrade indicator variables show that realized volatilities are indeed heightened. Taken together, this suggests that sovereign rating events are more destabilizing on stock than currency markets during periods of financial turmoil.

In comparing the impacts of outlook changes and actual rating changes (Eq. (7)), we find that outlook changes significantly affect stock market realized volatilities at the 5% level of significance but rating changes alone are insignificant. This suggests that the more forward-looking and shorter-term types of ratings guidance in the form of outlooks and credit watches on sovereign obligors have more informational value for stock market participants than permanent rating changes. This is possibly because rating changes (especially upgrades) are often leaked by governments prior to release and/or are already anticipated by market participants as they are usually preceded by outlooks and credit watches (Gande and Parsley (2004) and Kaminsky and Schmukler (2002)). This finding is consistent with Larrain et al's (1997) earlier finding that sovereign ratings have a particularly significant announcement effect on debt spreads when countries are put on review with negative outlook and Kaminsky and Schmukler's (2002) comparison on debt spreads and stock market returns. On the other hand, neither outlook changes nor rating changes impact significantly on currency market realized volatilities, consistent with its lack of response to rating events overall.

Rating impacts on realized skewness

Table 3 reports estimates of the panel regression models in Eq. (5-7) for realized stock and currency market skewness as measured by the Hutson et al.'s (2008) 'down-to-up' (DU) measure.[9] Consistent with their interpretation, a higher value of this measure corresponds with more left (negatively)-skewed return distributions.

<insert Table 3>

We find evidence that rating events have significant impacts on the third moments of both stock and currency returns. However, there is a different relationship in the two asset markets as rating events are negatively related to stock market skewness but positively related to currency market skewness and the effect is more persistent in the former. Again, we find evidence of heterogeneous trading reactions in these two different asset markets.

Interestingly, the skewness of neither asset markets is affected by financial crises with the exception of the FX market being significantly affected by the AFC at the 10% significance level.

In terms of asymmetries, stock market skewness responds significantly to upgrade phases but FX skewness responds asymmetrically. The signs are consistent across asset markets in that upgrades reduce skewness whilst downgrades increase skewness towards the left.

[9] As a robustness check, we also computed alternative skewness measures and the results were qualitatively similarly throughout. Estimation results for other skewness measures are available upon request from the corresponding author.

We find that outlook changes are also significant on market skewness measures, albeit more so for stock market skewness. Interestingly, currency market skewness is more significantly affected by actual ratings changes (5% level) than outlook changes (10% level). Again, this presents evidence of heterogeneous market responses to agency ratings guidance.

Rating impacts on realized stock-currency correlations

Table 4 presents the panel estimation results for realized correlations across same country stock and currency market returns. As can be seen, there is a significant negative relationship between rating events and cross-stock-FX correlations. This is consistent with the general finding in our study that stock markets are more sensitive to rating announcements than currency markets. Furthermore, this is emanated in asymmetries in realized cross-asset correlations. There is a positive relationship with downgrade phases as market participants in both asset markets heed 'bad news' regarding the country in the same manner. However, realized correlation tends to decline in upgrade phases as currency market participants are not responsive to rating upgrades whereas stock market participants are, corresponding with above results on realized volatilities. Interestingly, outlook changes and rating changes do not have differential impacts on the cross-asset market correlations, unlike for realized volatilities and skewness.

<insert Table 4>

We also find that cross-asset market correlations in developed countries within the Asia-pacific region are not significantly different during financial crises. This country sample is different to those used by other studies finding strengthened relationships

between stock and currency returns as a result of the AFC (for example, Kallberg et al. (2005), Phylaktis and Ravazzolo (2005) and Cumperayot et al. (2006)) and provides evidence that cross-stock-FX market contagion does not necessarily increase during financial turmoil. Whilst Kaminsky and Schmukler (2002) concludes that sovereign ratings generate cross-country financial contagion, we find that rating impacts are no more pronounced on same country cross-asset market comovements during periods of financial turmoil. This is a new finding for the current literatures on stock and currency market relations and rating impacts.

Rating spillover effects

Table 5 presents the panel estimation results for Eq. (8). We find that within our sample, the other markets in the Asia-pacific region were marginally affected by Korea's rating events but there were no spillovers from the other four markets' rating events into Korean stock and currency markets.[10] This is not surprising given that of the more developed Asian financial markets, Korea was the worst affected during the AFC. Again, we find evidence that realized skewness and volatility in stock markets were particularly responsive to rating spillover effects from Korea. However, the market impact of ratings spillovers are economically and statistically less significant than own country rating effects discussed above. These findings suggests that whilst the ratings events of advanced markets in the Asia-pacific are generally interpreted by market players as country-specific news, there were common information spillovers from Korea into the other developed Asian markets. As Korea's sovereign rating performance declined, the perception of riskiness in other Asian markets also

[10] Only rating spillover results from Korea are presented for brevity.

increased. The AFC was only significant in the realized volatilities of stock and currency markets.

<insert Table 5>

5. Conclusions

We examine the effects of different sovereign rating announcements and its spillover effects on stock and currency markets in the Asia-pacific region over 1997-2001 using ratings history from Standard and Poors and intradaily data on stock and currency markets from TACTIQ and Olsen.

This paper finds that currency and stock markets react heterogeneously to ratings announcements with stock markets being more responsive to rating news than currency markets. Changes on sovereign credit outlooks have more significant impact on realized volatility and skewness measures in stock markets but actual rating changes are more important in currency markets. We also find clear evidence that rating events have significant and asymmetric impacts on higher moments of both asset market returns. Downgrades generally have a more significant impact than upgrades with the exception that realized volatilities in stock markets increase with both rating upgrades and downgrade phases. Realized skewness increases with downgrades and declines with upgrades and realized stock-FX correlations increase with downgrades and decreases with upgrades. The AFC only increased the sensitivity of realized volatilities to ratings information. Finally, there were marginal rating spillover effects from Korea on other markets' realized measures. More developed and stable financial markets are less inclined to impart rating spillover effects into other asset markets in the region.

In a period where credit rating agencies are increasingly placed under the spotlight due to new international banking regulatory frameworks and failures to provide early warnings on financial crises, our findings are especially insightful. Our results provide clear evidence that rating announcements are heeded by market participants and consequently have significant impacts on financial market stability, albeit to differing extents across different asset markets.

In summary, we find new evidence that national sovereign rating events have significant impacts on the higher moments of stock and currency returns. Future research into the impacts of credit ratings on international financial markets need to recognize and account for this to fully capture the true extent of rating influence on asset returns.

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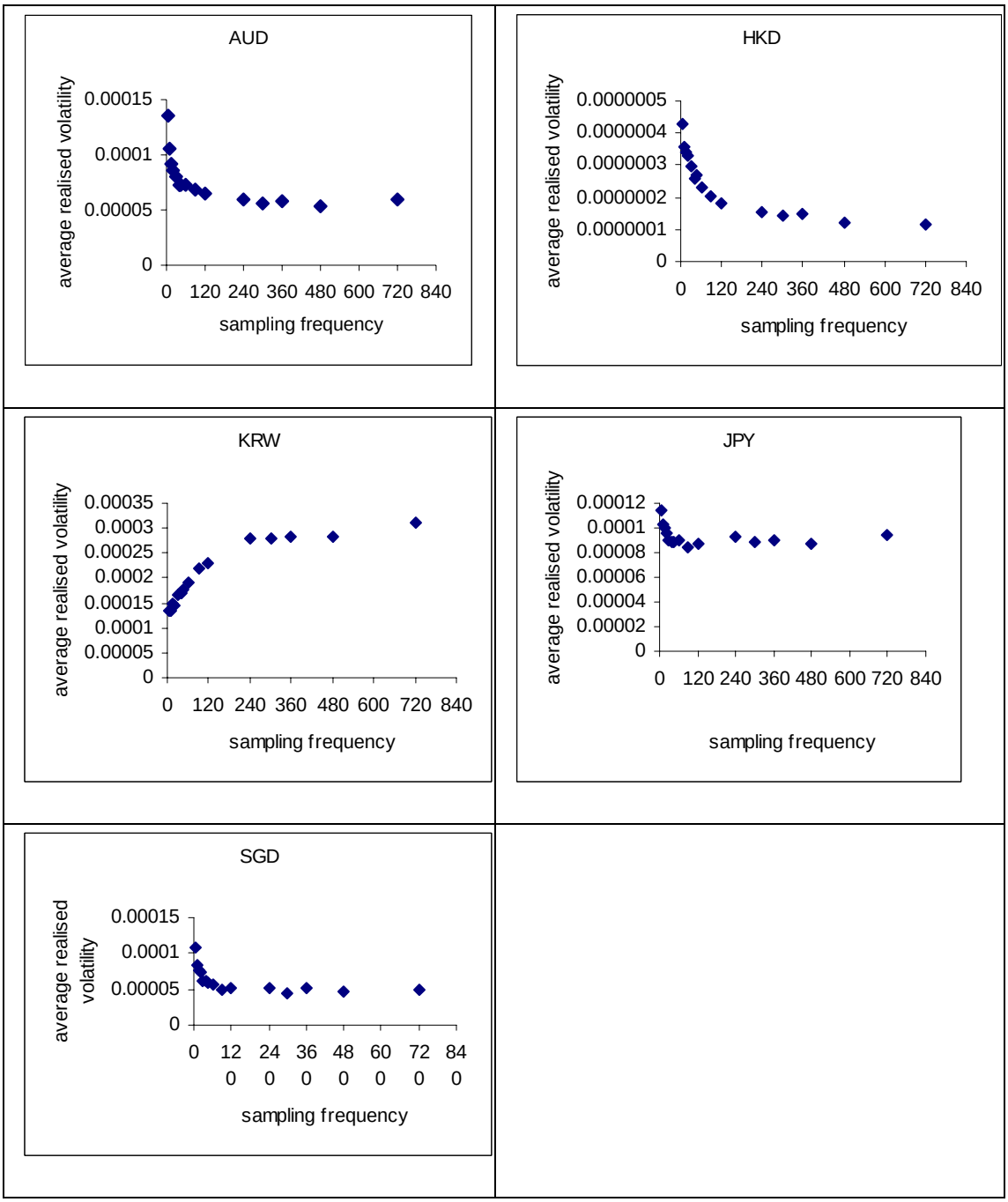
Figure 1. Realized volatility signature plots for Asian currency markets



This Figure shows the average daily realized volatilities generated under various intradaily sampling time intervals from 0 to 720 minutes.

Table 1. Descriptive statistics

	RV-stocks	RV-FX	RS-stocks	RS-FX	RC-stcks-FX
AUS					
Mean	0.00006	0.00007	-0.11585	0.05689	0.01005
Q(20)	268.86***	876.27***	19.609	28.207	26.307
ADF	-14.73019***	-12.67767***	-32.585***	-33.8063***	-32.0857***
HK					
Mean	0.00029	8.71E-08	-0.00459	-0.08671	-0.00419
Q(20)	908.4***	995.65***	62.725	24.308	41.891**
ADF	-10.48973***	-8.99729***	-30.01864***	-36.0447***	-34.3879***
JAP					
Mean	0.00018	6.93E-05	-0.01581	-0.04595	-0.05236
Q(20)	698.87***	1691.2***	22.588	13.296	99.836***
ADF	-9.71818***	-7.44377***	-33.5218***	-37.0499***	-16.5767***
KOR					
Mean	0.00061	0.00001	-0.05852	0.06202	-0.07246
Q(20)	1026.7***	2969***	108.33***	34.282**	44.468***
ADF	-9.22837***	-4.92291***	-27.406***	-31.3573***	-33.8132***
SGP					
Mean	0.00021	3.11E-05	0.02877	-0.02431	-0.00391
Q(20)	500.31***	2093.4***	35.597**	29.086*	8.8943
ADF	-10.72763***	-5.74081***	-30.3385***	-34.5366***	-34.9142***

This table reports the average for stock and currency market realized volatilities, skewness and cross-market correlations. The Q(20) statistics are for the Ljung-Box Q test for serial correlation up to 20 lags. The ADF test is for the null hypothesis of a unit root and the critical value at the 1% level of significance is 3.44. *, ** and *** denote significance at the 10, 5 and 1% levels.

Table 2. Impact of sovereign ratings on realized volatility in stock and currency markets

	Stock market volatility						FX market volatility					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
Const	0.0014***	0.0013***	0.0012***	0.0012***	0.0011***	0.0014***	0.0004***	0.0003***	0.0003***	0.0003***	0.0002***	0.0004***
	{0.0000}	{0.0000}	{0.0000}	{0.0000}	{0.0000}	{0.0000}	{0.0000}	{0.0000}	{0.0000}	{0.0000}	{0.0000}	{0.0000}
Event	-0.0020	-0.0002	-0.0002	-0.0002	-0.0004		-0.0001	-0.0001	-0.0002	-0.0001	-0.0001	
	{0.2865}	{0.2294}	{0.2078}	{0.2794}	{0.7913}		{0.1953}	{0.1763}	{0.1647}	{0.2151}	{0.5645}	
Lag Event	-0.0004**	-0.0004***	-0.0005***	-0.0004**	-0.0003*		-0.0002	-0.0002	-0.0002	-0.0001	-0.0001	
	{0.0120}	{0.0092}	{0.0083}	{0.0121}	{0.0784}		{0.3804}	{0.3590}	{0.3454}	{0.3979}	{0.6438}	
CCR	-0.0007***	-0.0006***	-0.0006***	-0.0006***	-0.0005***	-0.0001***	-0.0002***	-0.0002***	-0.0002***	-0.0001***	-0.0000***	-0.00002***
	{0.0000}	{0.0000}	{0.0000}	{0.0000}	{0.0000}	{0.0000}	{0.0000}	{0.0000}	{0.0000}	{0.0000}	{0.0001}	{0.0000}
AFC	0.0002***			0.0002***		0.0002***	0.0001***			0.0001***		-0.0001***
	{0.0000}			{0.0000}		{0.0000}	{0.0000}			{0.0000}		{0.0000}
GFC		0.0001***						0.00003***				
		{0.0004}						{0.0000}				
RFC			0.0002***						0.00004***			
			{0.0000}						{0.0000}			
DG				0.0001***						0.0001***		
				{0.0018}						{0.0001}		
UG				0.0001***						0.0000		
				{0.0000}						{0.6848}		
DG×AFC					0.0011***						0.0005***	
					{0.0000}						{0.0000}	
UG×AFC					0.0004***						0.0000***	
					{0.0000}						{0.0001}	
Outch×Event						-0.0005**						-0.0002
						{0.0126}						{0.1433}
Ratch×Event						-0.0002						0.0000
						{0.2417}						{0.9603}
Adj. R-sq	0.1885	0.1778	0.1793	0.1919	0.2345	0.1877	0.1177	0.1044	0.0978	0.1361	0.2511	0.1097
Nobs	6065	6065	6065	6065	6065	6065	6065	6065	6065	6065	6065	6065

This table presents the panel estimation results for stock and FX market realized volatilities over the sample 7/1/1997 to 30/8/2001. Model specifications (1)-(3) are based on Eq. (5); specifications (4)-(5) are based on Eq. (6) and speciation (6) is based on Eq. (7). The crisis periods are from 1/7/1997-30/1/1998 (AFC); 1/8/1998-30/10/1998 (RFC) and the GFC includes the sum of the Asian, Russian, Brazilian (1/2/1999-28/2/1999) and Turkish (1/2/2001-28/2/2001) financial crises. The UG coefficient is from a separate regression to avoid collinearity issues. *, ** and *** denote significance at the 10, 5 and 1% levels.

Table 3. Impact of sovereign ratings on realized skewness in stock and currency markets

	Stock market skewness					FX market skewness				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
Const	-1.744***	-1.723***	-1.753***	-1.8534***	-1.7927***	1.9640***	2.0589***	2.0500***	2.3767***	1.9858***
	{0.0019}	{0.0015}	{0.0013}	{0.0011}	{0.0017}	{0.0004}	{0.0002}	{0.0002}	{0.0001}	{0.0001}
Event	-0.7976***	-0.7609***	-0.7812***	-0.8150***		0.5567***	0.5694***	0.5797***	0.5313***	
	{0.0047}	{0.0061}	{0.0052}	{0.0048}		{0.0033}	{0.0022}	{0.0017}	{0.0089}	
Lag Event	-1.1129***	-1.076***	-1.0965***	-1.1304***		-0.7520	-0.7393	-0.7290	-0.7775	
	{0.0006}	{0.0008}	{0.0007}	{0.0006}		{0.3962}	{0.4029}	{0.4089}	{0.3852}	
CCR	0.0994***	0.0954***	0.0991***	0.1024***	0.1021***	-0.1133***	-0.1167***	-0.1188***	-0.1352***	-0.1146***
	{0.0021}	{0.0022}	{0.0014}	{0.0016}	{0.0019}	{0.0004}	{0.0003}	{0.0002}	{0.0001}	{0.0001}
AFC	-0.0744			-0.0565	-0.0596	-0.1082*			-0.1077*	-0.0997
	{0.5693}			{0.6636}	{0.6499}	{0.0980}			{0.0985}	{0.1467}
GFC		0.1148					-0.0587			
		{0.1877}					{0.2299}			
RFC			0.0979					-0.0619		
			{0.6259}					{0.4927}		
DG				0.1333					0.2873***	
				{0.2555}					{0.0001}	
UG				-0.1913**					-0.1383**	
				{0.0213}					{0.0348}	
Outch×Event					-1.0220***					0.3494*
					{0.0010}					{0.0530}
Ratch×Event					-0.2357					0.8453**
					{0.4616}					{0.0112}
Adj. R-sq	0.0048	0.0053	0.0048	0.0057	0.0032	0.0099	0.0097	0.0975	0.1361	0.0082
Nobs	6065	6065	6065	6065	6070	6065	6065	6065	6065	6065

This table presents the panel estimation results for stock and FX market realized skewness (based on the DU measure) over the sample 7/1/1997 to 30/8/2001. Model specifications (1)-(3) are based on Eq. (5); specifications (4)-(5) are based on Eq. (6) and speciation (6) is based on Eq. (7). The crisis periods are from 1/7/1997-30/1/1998 (AFC); 1/8/1998-30/10/1998 (RFC) and the GFC includes the sum of the Asian, Russian, Brazilian (1/2/1999-28/2/1999) and Turkish (1/2/2001-28/2/2001) financial crises. The UG coefficient is from a separate regression to avoid collinearity issues. *, ** and *** denote significance at the 10, 5 and 1% levels.

Table 4. Impact of sovereign ratings on realized correlation between stock and currency markets

	(1)	(2)	(3)	(4)	(5)	(6)
Const	-0.0582	-0.0645	-0.0595	-0.0759	-0.0421	-0.0523
	{0.4077}	{0.3531}	{0.3932}	{0.3124}	{0.5426}	{0.4569}
Event	-0.0599*	-0.0639*	-0.0629*	-0.0588*	-0.0573*	
	{0.0708}	{0.0547}	{0.0573}	{0.0778}	{0.0820}	
Lag Event	0.0144	0.0104	0.0114	0.0155	0.0170	
	{0.6959}	{0.7784}	{0.7574}	{0.6722}	{0.6340}	
CCR	0.0019	0.0024	0.0021	0.0028	0.0014	0.0015
	{0.6517}	{0.5494}	{0.6097}	{0.5201}	{0.7288}	{0.7147}
AFC	0.0139			0.0139	0.0112	0.0143
	{0.1724}			{0.1732}	{0.2635}	{0.1570}
GFC		-0.0056				
		{0.4376}				
RFC			-0.0119			
			{0.3943}			
DG				0.0124**		
				{0.0144}		
UG					-0.0282***	
					{0.0050}	
Outch×Event						-0.0474
						{0.3337}
Ratch×Event						-0.0541
						{0.1459}
Adj. R-sq	0.0128	0.0126	0.0126	0.0128	0.0140	0.0128
Nobs	6065	6065	6065	6065	6065	6065

This table presents the panel estimation results for cross-stock-FX market realized correlations over the sample 7/1/1997 to 30/8/2001. Model specifications (1)-(3) are based on Eq. (5); specifications (4)-(5) are based on Eq. (6) and speciation (6) is based on Eq. (7). The crisis periods are from 1/7/1997-30/1/1998 (AFC); 1/8/1998-30/10/1998 (RFC) and the GFC includes the sum of the Asian, Russian, Brazilian (1/2/1999-28/2/1999) and Turkish (1/2/2001-28/2/2001) financial crises. *, ** and *** denote significance at the 10, 5 and 1% levels.

Table 5. Rating spillover effects from Korea

	RV-stocks	RV-FX	RS-stocks	RS-FX	RC-stocks-FX
Constant	-0.0002	0.00006	-4.0567**	0.0077	0.1626
	{0.3932}	{0.1871}	{0.0106}	{0.9919}	{0.3550}
Event_Korea	-0.00002	0.00001	-0.5731***	0.0591	0.0187
	{0.3827}	{0.1072}	{0.0005}	{0.4585}	{0.3072}
Lag	0.00005*	0.00001	-0.0809	-0.0246	-0.0281
Event_Korea	{0.0588}	{0.1304}	{0.6246}	{0.7581}	{0.1245}
CCR_Korea	-0.00002***	-0.00001***	0.0125	0.0086	0.0030**
	{0.0000}	{0.0000}	{0.3238}	{0.1569}	{0.0323}
CCR_others	0.00003***	0.00000	0.2097**	-0.0076	-0.0117
	{0.0072}	{0.2472}	{0.0147}	{0.8549}	{0.2209}
AFC	0.00014***	0.00002***	0.0064	-0.0131	0.0167
	{0.0000}	{0.0000}	{0.9479}	{0.7804}	{0.1219}
Adj. R-sq	0.0949	0.2140	0.0031	0.0015	0.0109
Nobs	4852	4852	4852	4852	4852

This table presents the rating spillover effects from Korea to other sample countries in the Asia-pacific region. The model specification is based on Eq. (8). The AFC crisis period is from 1/7/1997-30/1/1998. *, ** and *** denote significance at the 10, 5 and 1% levels.

Appendix

Table A.1
Comprehensive credit rating computation from S&P sovereign ratings guidance

Long-term Ratings	
Rating	Conversion
	Investment grades
AAA	20
AA+	19
AA	18
AA-	17
A+	16
A	15
A-	14
BBB+	13
BBB	12
BBB-	11
	Speculative grades
BB+	10
BB	9
BB-	8
B+	7
B	6
B-	5
CCC+	4
CCC	3
CCC-	2
CC	1
D/SD	0

Short-term ratings guidance	
Outlook	Conversion
Credit Watch - Positive	+0.5
Positive	+0.25
Stable	0
Negative	-0.25
Credit Watch - Negative	-0.5