The dynamic pricing of sovereign risk in emerging markets: fundamentals and risk aversion

Eli Remolona*, Michela Scatigna* and Eliza Wu**[1]

** Bank for International Settlements (BIS), Representative Office for Asia and the Pacific, Hong Kong.*

*** School of Banking and Finance, Faculty of Business, University of New South Wales, Sydney, NSW 2052, Australia.*

Abstract

We propose a dynamic market-based measure of sovereign risk and use it to decompose sovereign credit default swap (CDS) spreads into, first, expected losses from default and, second, the risk premia required by investors as compensation for default risk. Doing so reveals that country-specific fundamentals primarily drive sovereign risk whilst global investors' risk aversion drives time variation in risk premia. Consistent with this, we find the sovereign risk premia is more highly correlated than sovereign risk itself in emerging markets. These results help us to explain the remarkable narrowing of emerging market spreads between 2002 and 2006.

JEL Classification Numbers: F30, G15

Keywords: sovereign risk; default risk premia; risk aversion; credit default swaps; credit ratings; emerging markets

---

[1] This paper was written whilst Eliza Wu was visiting the BIS from the University of New South Wales. Corresponding author: Eli Remolona, Bank for International Settlements, Hong Kong, tel +852 2878 7145, email eli.remolona@bis.org. Authors wish to thank Moody's and S&P for providing sovereign data and information used in this study. Authors are also grateful to seminar participants at the Asian Development Bank Institute, BIS, Bangko Sentral ng Pilipinas, Bank of Japan, Bank of Thailand, Chinese University of Hong Kong, Hong Kong Institute for Monetary Research and Hong Kong University of Science and Technology for

1. Introduction

Emerging market debt valuations now appear stretched relative to their historical relationship with fundamentals and liquidity (IMF, 2004).

Between October 2002 and December 2006, spreads on sovereign bonds and credit default swaps (CDS) fell to levels that had historically never been seen – even below levels reached prior to the 1997 Asian financial crisis. For example, the CDS spread on the Philippines -- regarded as the benchmark for emerging markets in Asia -- declined from over 500 basis points near the start of that period to about 130 basis points towards the end of the period. Indeed by 2005, sovereign spreads had narrowed to the point where serious concerns were expressed within policy circles that market participants may be failing to adequately recognise the risks of emerging market debt. But how narrow was too narrow? The problem is that there seemed to be little basis for deciding the issue other than the fact that the spreads seemed to be rather tight relative to past regularities in fundamentals and liquidity levels.

A common difficulty in analysing sovereign spreads is the question of how to distinguish between risk and the pricing of risk, in which the latter the reflects compensation demanded by investors for bearing sovereign default risk. In general, asset prices are driven by both fundamentals and investors' appetite for risk. Hence, we may think of the level of sovereign risk as being driven by the country's economic fundamentals and the pricing of that risk as depending on investors' risk aversion (which may vary over time) as well as on the risk itself. Yet the sovereign debt literature on the whole, has largely focussed on the determinants of sovereign risk and has been silent on the pricing mechanics, often implicitly assuming that somehow sovereign spreads reflect risk but not risk premia. This study attempts to fill this vacuum in the sovereign risk literature by proposing a framework for distinguishing sovereign risk from its risk premia. We provide empirical evidence on

---

useful discussions and comments. All errors remain our own. The views expressed in this paper are those of the authors and do not necessarily reflect those of the Bank for International Settlements.

the difference between the effects of fundamentals and risk aversion on sovereign debt spreads.

In the recent literature on the pricing of credit risk in corporate bonds, Driessen (2005), Amato and Remolona (2005) and Berndt et al (2005) decompose corporate bond spreads into expected losses from default and the price of risk, namely the default risk premium. We apply this decomposition framework to investigate whether expected losses depend on the fundamentals of issuers' creditworthiness and the default risk premia on factors that affect investors' risk aversion. To do so, we build upon and extend the concept of ratings-implied expected loss introduced by Remolona, Scatigna and Wu (2007b), a concept which relies critically on the information content of credit ratings and the default and recovery histories of rated bonds. The advantage of such information is that it is information to which market participants react in pricing credit risk. With estimates of expected losses, we then derive risk premia by using a comprehensive database on credit default swap (CDS) spreads. Credit derivatives are a rapidly growing part of the sovereign debt market and they are considered to be much more liquid than cash instruments. Morever, a CDS contract presents an insurance cover from default risk that provides a straightforward measure of credit risk.

An important shortcoming of risk information from credit ratings is that assigned ratings only adjust slowly to the arrival of information which market participants may consider to be relevant to asset valuations. To take timely account of new market information, we introduce a dynamic market-based model for sovereign risk pricing. The improvement with our market-based approach rests upon the incorporation of information updates based on real-time economic data and rating agencies' more timely information as conveyed in watchlists and outlooks. The model is specified to capture market participants' updating of their expectations on sovereign risk as information on fundamentals arrive. Specifically, we construct improved measures of expected loss by relying on sovereign credit ratings and adjusting for short-term rating announcements and hence, information on the default probabilities for the issuer. By assuming that market participants quickly adjust their assessments of risk to reflect their forecasts of how credit ratings will adjust, we are able to derive higher-frequency estimates of sovereign default risk. In this way, we are also able to derive

time-varying estimates of sovereign default risk premia as perceived by market participants in our contribution to understanding sovereign risk pricing mechanics.

To further demonstrate the difference between sovereign risk and risk premia, we stage a horse race that differentiates between the determinants of one from the determinants of the other. In particular, we investigate the effects of variables reflecting country-specific fundamentals and variables reflecting global investors' risk aversion. We find statistically significant effects of global risk aversion on the sovereign risk premium but not on sovereign risk itself, which is determined primarily by country-specific fundamentals. This is further supported by aggregate correlation analyses revealing that sovereign risk premia are consistently more highly correlated than sovereign risk levels across regions. In particular, we find that the Asian region is the most disparate suggesting that market participants disregard sovereign risk levels to a greater extent in their pricing of sovereign debt in Asia.

The remainder of this paper is structured as follows: Section 2 introduces the concepts of sovereign risk and its risk premia and explains how they enter into sovereign spreads. Section 3 explains our model for deriving a dynamic measure of expected losses from sovereign default and a time-varying measure of sovereign default risk premia and section 4 describes our data used. Section 5 compares our market based measure of sovereign default risk with the rating agency implied views. Section 6 examines in detail the role of investors' risk aversion in the pricing of sovereign debt and Section 7 moves on to the implications for spreads. Finally, Section 8 concludes and suggests further work to be done in this area.

2. The components of sovereign spreads

A sovereign spread is supposed to compensate investors for the risk of default. One component of this compensation should be the expected loss from sovereign default. For investors who hold the sovereign bond to maturity, this loss is simply the product of the probability of default and the loss-given-default. For investors who plan to sell before maturity, the expected loss would also incorporate the prospect of a decline in credit quality short of default. Another component of the spread is attributable to the risk premium. Such a premium compensates investors for the fact that the realised

loss from default may exceed the expected loss. Such a default risk is asymmetric because the possible losses from default are large relative to the possible gains from an absence of default.

Hence, as a measure of credit risk, the probability of default enters the spread in two ways. First, it is part of expected loss in conjunction with the expected recovery rate. Second, it is part of the risk premium, the other part being the price of risk. But how significant is the risk premium component? Jarrow et al (2005) have laid down the conditions for the absence of a default risk premium in a world of risk-averse investors. First, defaults on different bonds must be independent. Second, investors must be able to diversify away any idiosyncratic risks by holding a sufficiently large portfolio of bonds. Whether these conditions hold is an empirical question.

In the case of corporate bonds, the empirical evidence points to a rather large risk premium. Indeed, this risk premium is estimated to be such a large part of credit spreads that Driessen (2005) and Amato and Remolona (2003) have called the phenomenon the "credit spread puzzle". Driessen estimates an average premium of 189 basis points after accounting for tax and liquidity effects. Berndt et al (2005) estimate an average premium of a similar magnitude, and moreover find that the risk premium varies greatly over time. For a portfolio of BBB/Baa-rated corporate bonds, Amato and Remolona (2005) have estimated that default correlations account for about three quarters of the risk premium and undiversifiable idiosyncratic jump risk for one quarter.

Nonetheless, the presumption that credit spreads measure just default risk but not risk premia is common among recent papers in the sovereign debt literature proposing structural models to measure probabilities of sovereign defaults. Gapen et al (2005) and Oshiro and Saruwatari (2005), for example, apply the standard structural Merton model for corporate credit risk by defining for countries concepts of balance sheet leverage and option volatility. They then judge their approaches to be good ones because they find their risk indicators to be highly correlated with market spreads over time. Similarly, Diaz Weigel and Gemmill (2006) fit a similar structural model to par Brady bond prices to derive a "distance-to-default" measure of sovereign risk. They express surprise that country-specific variables account for only 8% of the explained variance of their distance-to-default measure. However, a

possible reason for this result is that their distance-to-default measure largely reflects risk premia driven by the extent of investors' time-varying risk aversion. As Duffie, Pedersen and Singleton (2003, p.122) highlight, "Structural models, which directly capture the default incentives and solvency of the issuer, can be problematic when empirically modeling sovereign debt."

The empirical pricing kernel literature has developed market-implied measures of investor risk aversion that exploit information from options prices. These measures tend to imply a high degree of time variation in risk aversion. The concept of risk aversion has also been linked with emerging market debt spreads by McGuire and Schrijvers (2003), Baek, Bandopadhyaya and Du (2005), Garcia-Herrero and Ortiz (2006) and references therein. McGuire and Schrijvers correlate a principal component of emerging market spreads to the volatility implied by options on the S&P 500 index (the well-known, VIX) whilst the latter studies compute ad hoc risk appetite indicators which are significant for Brady bond yield spreads and/or Emerging Market Bond indices. These results motivates our attempt to better specify the role of risk aversion in sovereign risk pricing in a dynamic framework.

3. A dynamic market-based model of sovereign risk

The dynamics of sovereign risk pricing need to be analysed at a relatively high frequency. Hence, we measure sovereign risk at the monthly frequency by deriving a market-based measure that extends the work of Remolona, Scatigna and Wu (2007b) on ratings implied expected losses (RIEL) for sovereign issuers. In their work, expected losses from sovereign defaults are modelled as a non-linear mapping of sovereign credit ratings. Specifically, a translation of default intensity across rating categories is calibrated using the average five-year ahead default rates of both sovereign and corporate issuers (as an estimate of the unconditional 5 year default probability).

So why do we rely on information from credit ratings? In the country risk literature, the preferred source of information seems to be the *Institutional Investor* country ratings.[2] Nonetheless, there are good reasons to rely on credit ratings instead. As explained by Borio and Packer (2004), such ratings have the following advantages: (a) rating agencies explain their criteria and rating methodologies while respondents to the *Institutional Investor* survey do not; (b) rating agencies stake their business on the accuracy of their ratings while respondents to the *Institutional Investor* survey are anonymous and not held to account for their responses. Moreover, Micu, Remolona and Wooldridge (2006) find that corporate credit default swap spreads react significantly to announcements made by credit rating agencies. Since we wish to estimate sovereign risk as judged by market participants, it is important to use information on which they evidently rely.

In this study, we extend the RIEL measure of Remolona, Scatigna and Wu (2007b) (henceforth, RSW-RIEL) for sovereign default risk because the relevant information for assessing an issuer's creditworthiness arrives at a higher frequency than that based solely on sovereign ratings guidance, which by rating agencies' own admission are slow to adjust to the arrival of new information in the market. Altman and Rijken (2004) suggest that rating agencies focus on a long-term horizon (in using a "through-the-cycle" rating methodology) and thus aim to respond only to the perceived permanent component of credit-quality changes in their ratings guidance. However, market participants on the other hand adjust their risk assessments quickly as information arrives and they price financial assets accordingly. The problem with such market assessments is that they are not directly observable. In this study, we derive market-based expected losses from sovereign default (MBEL) in two stages – first by accounting for short-term rating announcements and second by means of a market adjustment equation that is estimated with observable instrumental variables. This allows us to mimic the formation of investors' expectations on sovereign default risk at the monthly frequency based on changing economic conditions in emerging markets.

---

[2] These ratings are in Baek, Bandopadhyaya and Du (2005), Reinhart et al (2003) and Ul-Haque et al (1996).

3.1 Modeling rating agency announcements

Whilst rating agencies provide credit ratings to signal an issuer's long-term fundamental creditworthiness they also provide more short-term signals via reviews and outlooks to forewarn investors of the likely change of an issuer's credit quality in the near term. The latter are made by rating agencies when a significant event or deviation from an expected trend has either occurred or is expected to affect an issuer's capacity to repay its debt.

Micu, Remolona and Wooldridge (2006) examine the price impact of more timely rating announcements in the form of reviews and outlooks on corporate issuers. They find that investors value both the timely signals (rating reviews and outlooks) as well as the stable signals (ratings) of issuer creditworthiness. This is consistent with rating agencies' view that ratings, watchlists and outlooks together give a complete rating guidance on the issuer's capacity to meet its financial obligations. However, as the rating reviews for sovereign ratings are called "Creditwatch" (by S&P) and "Watchlists" (by Moody's) we will use the terms "review" and "sovereign watch" interchangeably in this paper.

Thus, in order to capture the additional information implied by sovereign rating outlooks and watches, we adjust and extend the ratings implied expected loss (RIEL) measure of Remolona, Scatigna and Wu (2007b) – RSW-RIEL. In our model, we assume that rating announcements have symmetric impacts on sovereign debt markets and that credit watches are more likely to lead to a subsequent ratings change than ratings outlooks. Guided by discussions with rating agencies, we assign a rating transition probability (p) of 0.3 for outlooks and 0.6 for credit watches and we compute the weighted RIEL average when there is a non-stable rating announcement. Specifically, we adjust a positive outlook or sovereign watch up by one notch in the rating scale and a negative outlook or sovereign watch down by one notch to infer the probabilities of default based on historical sovereign default experiences. Based on ratings agencies' suggestions, we assume that the sovereign watches last for 3 months and outlooks for 2 years or until the next actual rating change, whichever is sooner. Following the RSW-RIEL methodology and the findings of Sturzenegger and Zettlemeyer (2005) we use a constant loss given default rate of 45%. We calculate the expected value of ratings implied expected

loss (RIEL) by adjusting for rating announcements – this can be represented as weighted averages shown:

$$E(RIEL_{adjusted_{i,t}}) = \begin{cases} 0.7 \times PD_{0i,t} \times \overline{LGD} + 0.3 \times PD_{1i,t} \times \overline{LGD} & \textit{For Outlooks} \\ 0.4 \times PD_{0i,t} \times \overline{LGD} + 0.6 \times PD_{1i,t} \times \overline{LGD} & \textit{For Watches} \end{cases} \quad (1)$$

where $PD_{0i,t}$ is the original annualized ratings implied probability of default and $PD_{1i,t}$ is the new rating outlook/watch implied probability of default for country *i* at time *t* and $\overline{LGD}$ is the constant loss given default scaling factor.

In this way, we improve upon the arbitrary adjustments made to linearly transformed sovereign rating scales in Gande and Parsley (2005) and Kim and Wu (2007). The advantage of our approach is that we use realistic assumptions to calibrate our ratings-based expected loss measure. We combine the adjusted RIEL series using both S&P and Moody's announcements in between actual rating changes. There is added informational value in this approach as Cantor et al. (1997) have shown split ratings to be priced in the mid point. Hence, there is no reason to believe that split short-term credit announcements by rating agencies will have widely different effects.

3.2 Estimating a market-based measure of sovereign risk

Next, we assume that the aggregate market's expected loss (market based expected loss, MBEL) should adjust toward expected ratings implied expected loss. We model this market adjustment process using the following equation:

$$l_t^M = (1-f)\,\hat{l}_{t+1}^R + f\,l_{t-1}^M + v_t\,, \quad (2)$$

where l_t^M is the MBEL, $\hat{l}_{t+1}^R$ is the expected RIEL forecast (adjusted for outlooks and reviews) and f is the adjustment coefficient (assumed to be between 0 and 1) and where we suppress the country subscript *i.*

In order to obtain estimates of the MBEL we rewrite (2) in terms of differences by subtracting l_{t-1}^{M} from both sides to yield:

$$l_t^M - l_{t-1}^M = (1-f)\left[\hat{l}_{t+1}^R - l_{t-1}^M\right] + v_t \qquad (3)$$

We apply two stage least squares (2SLS) to estimate equation (3), using the sovereign CDS spread S_t as a proxy for the MBEL, with the predicted values being our estimate for the MBEL. The estimated equation is thus:

$$S_t^* - S_{t-1}^* = (1-f)\left[\hat{l}_{t+1}^R - S_{t-1}^*\right] + u_t \qquad (4)$$

where S_t^* is the CDS spread adjusted by a factor k_j which measures the relative level of the adjusted RIEL with respect to the sovereign spread for each country *j*

$$k_j = \frac{average(RIEL_J)}{average(S_J)} \quad j = 1,.....,24$$

and

$$l_{t+1}^R = f(F_t) + e_t \qquad (5)$$

In estimating (4) we assume that the (forecasted) adjusted RIEL is a function of a set of observable economic fundamentals F_t available in the previous month (as shown in equation (5)) which we use as instruments in the 2SLS estimation. Otherwise, the use of a regressor estimated with error in predicting MBEL will introduce unnecessary bias. The fundamental variables used are country-specific economic variables which are available at a monthly frequency and deemed to be relevant in the country risk

literature. These include inflation, industrial production, GDP growth consensus forecasts, export growth and foreign exchange reserves.

3.3 Deriving sovereign risk premia

Based on the analytical framework established in the corporate credit risk pricing literature, we make use of physical (actual observed probabilities of default) and risk-neutral measures (credit spreads incorporating risk aversion) (see Duffie and Singleton (2003) and references therein). Hence, we can define the sovereign default risk premium as the difference between the contemporaneous spread and our estimate of the market's actual view on expected loss:

$$p_t \equiv S_t - \hat{l}_t^M \tag{6}$$

where p_t is the sovereign risk premium, and as before, S_t is the CDS spread and $\hat{l}_t^M$ is the predicted expected loss from default in the form of MBEL, again suppressing the country subscript *i*. In fact, a logarithmic expression of this relationship lends nicely to our interpretation of the sovereign risk premia as the price of sovereign default risk (that is, price per unit of expected loss) as shown below:

$$\ln(p_t) = \ln(\frac{S_t}{\hat{l}_t^M}) \tag{7}$$

Our testable hypothesis is that this risk premium should depend on global risk factors as well as the level of sovereign risk itself but not separately on the fundamentals that determine the risk. Hence, we consider the following equation

$$\ln(p_t) = d_0 + d_1 \ln(l_t^M) + d_2 G_t + d_3 F_t \tag{8}$$

where the new variable G_t is investors' risk aversion or appetite indicator and F_t the country-risk fundamentals as before. The specific hypothesis is that the fundamentals F_t, which enter l_t^M in equation (4), do not enter separately in equation (8). The logarithmic forms follow Berndt et al (2005), who find such a relationship between default risk premia and default intensity in corporate bonds.

Note that in our model the risk plays two important roles: First it serves as a determinant of the market CDS spread (l_{t+1}^R), as defined in (5); and second it is our measure of risk (l_t^M) and is therefore a determinant of the risk premium, as in equation (8). It has the advantage of incorporating not only all information material to assessing a sovereign issuer's credit worthiness from rating agencies but also from the market as a whole.

4. Data

Our sample comprises 24 small and/or emerging markets from the regions of Latin America, Central and Eastern Europe, Asia and the Middle East and Africa (MEA) (see Appendix A for the list of sample countries studied). Our sample period is from January 2002 to May 2006 for which sovereign CDS market data are available for all countries in the sample.

We rely on sovereign foreign currency credit ratings history for each country including five-year issuer-weighted cumulative average default rates by ratings for sovereign and corporate issuers from *Moody's Investor Services, Standard and Poors* (S&P) and Fitch.

In addition, we use 5 year sovereign credit default swap (CDS) spreads sourced from the comprehensive *Markit* database. This unique database contains monthly quotes on CDS market spreads for 70 developed and emerging market sovereign obligors worldwide. As the sovereign CDS market enables the exchange of sovereign risk

between participating financial institutions, *Markit* compiles quotes from a large sample of financial institutions and aggregates them into a composite spread that is reasonably continuous. Another advantage is that these contracts do not suffer from declining maturities like conventional debt instruments. Moreover, we use only the five-year spreads because these contracts are the most liquid and account for a large proportion of the sovereign CDS market. Zhu (2004) finds CDS spreads react particularly faster to bad news than spreads in the underlying cash market. CDS spreads have also been analysed by Pan and Singleton (2006) and Longstaff et al (2005) for sovereign and corporate obligors respectively.

The set of country-specific fundamental explanatory variables used include inflation, industrial production, GDP growth consensus forecasts, export growth and foreign exchange reserves. These variables are all available at the monthly frequency from 2002 to 2005. They are sourced separately from the International Monetary Fund (IMF), Consensus Economics, Datastream, Moody's Investor Services, *Markit*, JPMorgan Chase and Standard & Poor's.

5. Dynamics of sovereign risk: comparing alternative measures

As our dynamic market based sovereign risk measure is an extension from the RSW-RIEL measure, we compare our augmented risk measure with its predecessor. The incremental improvement with our innovative market based approach rests upon the incorporation of information updates based on real-time economic data and rating agencies' shorter-term watchlists and outlooks. We find that accounting for these information releases substantially improves the information content of our sovereign risk measure over the pure ratings based alternative introduced by Remolona, Scatigna and Wu (2007b).

To illustrate the behaviour over time of the estimates of expected loss using ratings alone (RSW-RIEL) and additional rating outlooks and watches (adjusted RIEL), Figure 1 shows them for four countries: China, Korea, Thailand and the Philippines. As we would expect, the RSW-RIEL estimates tend to remain stable for extended

periods of time and then adjust abruptly and sharply, ultimately converging to the MBEL estimates which share a similar but smoother pattern to both RSW-RIEL and adjusted RIEL in between. In accounting for the additional information that is available to market participants, the MBEL consistently moves ahead of the ratings based measures of expected loss. In the cases of China, Korea and Thailand, the RSW-RIEL, adjusted RIEL and hence MBEL estimates all reflect progressive rating upgrades over the sample period. Conversely, there has been a progressive rating downgrade for the Philippines with the market disagreeing with this view.

<Insert Figure 1 >

6. The role of global risk aversion

In this study, our main hypothesis is that the sovereign default risk premium should depend on factors that affect investors' risk aversion as well as on the risk itself. In this section, we derive default risk premia and test whether they are significantly affected by other factors, in particular the country risk fundamentals and liquidity effects that enter into our measure of country risk.

6.1 Identifying global risk aversion

We first turn to the empirical asset pricing literature to identify global factors that affect investors' risk aversion. While there is a large literature purporting to analyse risk aversion (or sometimes risk appetite), much of it is based on ad-hoc measures that have little theoretical basis and often confuse risk aversion with liquidity. However, there actually exists a rigorous strand of research on risk aversion. In the literature on empirical pricing kernels, Ait-Sahalia and Lo (1998) and Jackwerth (2000) show how a theoretically sound measure of investors' risk aversion can be derived by comparing the return distributions implied by options prices to return distributions estimated from the realised movements of the underlying asset prices. Tarashev et al (2003) apply this approach to index options in stock markets and derive monthly estimates of investors' effective risk appetite. They find that these

indicators of risk attitude transcend national boundaries in their effects on financial markets.

Separately, in examining emerging market debt spreads McGuire and Schrijvers (2003) find a significant common factor in the movements of these spreads over time. They attempt to identify observable variables that are correlated with this common factor. Importantly, their results reveal a significant relationship with the implied volatility in equity index options on the S&P 500 index (the well-known VIX measure).

Motivated by these existing works, we proceed to use the Tarashev et al (2003) effective risk appetite indicator and the commonly used VIX to proxy investor's degree of risk aversion in our analyses.

6.2 Is sovereign risk really so different from risk premia? A horse race

To test our hypothesis, we stage a horse race to find which variables best explain sovereign risk and which ones best explain risk premia? We subject both our market based sovereign risk and risk premium dependent variables to be regressed against the set of country-specific fundamental variables and risk aversion proxies following the model specification shown in equation(8).

<Insert Table 1 >

The fixed effects panel regression results for the two dependent variables are reported in Table 1. As hypothesised, in the case of the sovereign risk equations we find that the effective risk appetite indicator does not add significant explanatory power for sovereign risk itself. However, risk appetite is evidently significantly related to the risk premia in a negative manner. This is an intuitive result suggesting that as investors' risk appetites increase, the risk premium demanded as compensation for sovereign default risk falls. The VIX interestingly has a positively significant effect on both risk and risk premia. As global volatility is heightened, risk increases and this also becomes priced into emerging debt markets. This result suggests that the VIX is

not a clean measure of risk aversion as it captures the volatility of global financial markets more generally. Based on the theoretical work of Ait-Sahalia and Lo (1998) and Jackwerth (2000) the Tarashev et al (2003) indicator is the superior proxy for capturing investors' effective attitude towards risk.

Our results from panel regression analyses using monthly data from February 2002 to May 2006 for 24 sample countries remain largely consistent with extant sovereign risk studies. The significant fundamental variables in the short-term have the appropriate signs – positive for inflation and negative for foreign exchange reserves – in explaining sovereign risk and risk premia. There appears to be a high level of persistence in both expected losses and the compensation for that. The goodness of fit for regressions at the monthly frequency are high (adjusted R-squared of 99% and 97% for risk and risk premium respectively) and the fixed effects estimation is warranted based on the Hausman test.

Hence, we find our decomposition of sovereign spreads into expected losses and risk premia to be validated by the fact that the latter component is largely explained by variables related to investors' risk aversion while the other component is determined primarily by country-specific fundamentals. This contribution makes sense of Baek, Bandopadhyaya and Du's (2005) finding that a risk aversion index can significantly explain brady bond yield spreads. Our results suggest that investors' true risk aversion affects primarily the price of sovereign risk and not the actual risk level itself.

6.3 A robustness check: controlling for liquidity

We also augment our fixed-effects panel regressions for sovereign risk and risk premia to account for the potential influences of illiquidity in emerging debt markets. As Longstaff et al. (2005) have shown that there are default and liquidity components in corporate CDS spreads, we attempt to control for any potential confounding effects from aggregate market liquidity.

The results of our control regressions are shown in Table 2. In addition to country-specific economic fundamentals, we find that market liquidity (as proxied by log net bond issuance) also explains market participants' perception of sovereign risk

(MBEL). The positively significant coefficient suggests that the major side effect of liquidity is that as issuance increases, the average quality of issuers must decline as more and more lower rated issuers are able to access arms length financing in emerging markets. Nevertheless, our finding that global risk aversion determines primarily the pricing of risk remains robust to the effects of market liquidity.

<Insert Table 2>

6.4 Regional correlations of sovereign risk and risk premia

To shed further insights into sovereign risk pricing, we refine our analyses further to focus on the commonalities in the behaviour of sovereign risk and risk premia over time both within and across regions. We compare regional averages in the pair-wise correlations between countries in estimated sovereign risk and risk premia. The most telling result shown in Table 3 is that the correlations in risk premia systematically exceed correlations in sovereign risk. This provides further support for the common global risk aversion factor driving sovereign risk pricing. This also corroborates with Diaz-Weigel and Gemmill's (2006) finding of significant market comovements in Brady Bond spreads over standard fundamental regressors. Another interesting discovery we find is that whilst the actual sovereign risk levels are the most divergent within the Asian region, sovereign risk premia is surprisingly the most correlated in emerging markets – even more so than Latin American markets. This can perhaps be explained by market participants' common pricing for Asian sovereign debt post Asian Financial crisis (which is akin to lumping sovereigns into a single 'Asian basket' in price formulation). The implication of this result is that market participants are clearly mispricing Asian sovereign debt the most – underpricing the risk in lower rated sovereigns that have remained fundamentally weak post-crisis (demanding a relatively lower risk premium) at the expense of higher rated sovereigns which are being potentially unfairly penalised by investors (with relatively higher risk premium than is warranted by their restored sovereign risk levels).

<Insert Table 3 >

7. Explaining emerging market spreads

We pursue further analyses on the Asian region to better understand the narrowing of spreads across emerging debt markets. In Figure 2, we show the CDS spreads and market based sovereign risk measures over time for sample Asian countries. Of these, China and Korea are investment grade issuers whilst Thailand and the Philippines are speculative (non-investment) grade.

The differences in the two grades of issuers are illuminating. For the investment grade group, whilst spreads have been falling in recent years, this is largely due to an actual decline in sovereign risk as economic conditions have improved (risk premium gaps have remained fairly stable). In contrast, the narrowing spreads of speculative grade issuers have largely come about from a major narrowing of the risk premium gaps. The actual levels of sovereign risk have not changed much at all but rather investors have become more strongly attracted to speculative grade debt. This confirms our previous finding that increasing global investor risk appetite has been pushing down the risk premia demanded for taking on sovereign default risk. Furthermore, this is also consistent with our finding that aggregate correlations for sovereign risk premia in Asia are the highest of all emerging markets whilst the levels of sovereign risk are the most divergent. The findings are revealing – whilst speculative grade issuers are getting away with paying risk premia that are closer to the those of higher rated sovereigns, the higher rated sovereigns are actually becoming much less risky than the lower rated ones. Overall, the convergence in emerging market debt spreads have resulted from declining sovereign risk levels at the investment grade end and declining risk premia at the speculative grade end of the emerging market debt spectrum.

<Insert Figure 2 >

8. Conclusions

This study contributes new international cross-country evidence on the mechanics of sovereign risk pricing in emerging markets. In doing so, it reconciles existing conflicts in the sovereign debt literature arising from the inability of existing frameworks to differentiate the market pricing of sovereign risk from the risk itself. Our empirical framework is consistent with the class of doubly stochastic models of default as it implicitly captures the degree of default correlation for the group of emerging market sovereigns (see Duffie and Singleton (2003)). Hence, our findings are of direct interest to emerging market participants, major financial institutions and monetary policy makers around the world as there are clear implications for bond pricing and portfolio credit risk management. We contribute a much better understanding on the recent developments in emerging debt markets.

In this study, we demonstrate how we may decompose sovereign debt spreads into two components: the expected loss from default and the default risk premium. We computed expected loss as a translation of default intensity using forward-looking credit ratings and announcements and the default histories associated with each rating. Hence, expected loss provides a useful measure of sovereign risk and is a highly non-linear mapping of a straight ratings measure. We then derived a higher frequency measure of expected loss by means of a dynamic market based model. We then used this measure to decompose sovereign spreads at the monthly frequency into expected loss and risk premium. Hence, expected loss can be interpreted as both a component of the sovereign debt spread as well as a measure of country risk.

We find strong evidence that expected losses and risk premia as measured behave differently. One is driven largely by country-specific sovereign risk fundamentals and market liquidity while the other moves beyond national boundaries with investors' global risk aversion as well as with changes in the sovereign risk itself. Further research is warranted on the microstructural effects of liquidity on sovereign debt valuations in the CDS market. We have simply presented a much needed new approach to formalising the pricing of sovereign debt in emerging markets to account for the puzzling convergence of emerging market debt spreads observed in recent years.

References

Ait-Sahalia, Y and A Lo (1998): “Nonparametric estimation of state-price densities implicit in financial asset prices,” Journal of Finance, 53, 499-547.

Altman, E I and H A Rijken (2004): “How rating agencies achieve rating stability”, Journal of Banking and Finance, 28, 2679-2714.

Amato, J D and E M Remolona (2003): “The credit spread puzzle”, BIS Quarterly Review, December.

Amato, J D and E M Remolona (2005): “The pricing of unexpected credit losses”, BIS Working Papers No 190, November.

Baek, ŁM, A Bandopadhyaya and C Du (2005): “Determinants of market-asessed sovereign risk: Economic fundamentals or market risk appetite?” Journal of International Money and Finance 24, 533-548.

Berndt, A, R Douglas, D Duffie, M Ferguson and D Schranz (2005): “Measuring default risk premia from default swap rates and EDFs”, BIS Working Paper No 173.

Borio, C and F Packer (2004): “Assessing new perspectives on country risk”, BIS Quarterly Review, December.

Cantor, R, F Packer and K Cole (1997): “Split ratings and the pricing of credit risk”, Journal of Fixed Income, 7(3).

Diaz-Weigel D D and G Gemmill (2006): “What drives credit risk in emerging markets? The roles of country fundamentals and market co-movements” Journal of International Money and Finance 25, 476-502.

Driessen, J (2005): “Is default event risk priced in corporate bonds?” Review of Financial Studies, 18, 165-195.

Duffie D, L H Pedersen and K J Singleton (2003): “Modeling sovereign yield spreads: A case study of Russian debt”, Journal of Finance, 58(1), 119-159.

Duffie D and K J Singleton (2003): Credit risk: Pricing, measurement and management, Princeton University Press.

Gapen, M T, D F Gray, C H Lim and Y B Xiao (2005): Measuring and analyzing sovereign risk with contingent claims. IMF Working Paper 155, August.

Garcia-Herrero, A and A Ortiz (2006): “The role of global risk aversion in explaining Latin American sovereign spreads”, Economia 6(2).

International Monetary Fund (2004): “Global Financial Stability Report”, World Economic and Financial surveys, April, Washington.

Jackwerth, J C (2000): “Recovering risk aversion from option prices and realized returns”, Review of Financial Studies 13, 433-451.

Kim, S-J and E Wu (2007): "Sovereign credit ratings, capital flows and financial sector development in emerging markets", working paper 01-07, University of New South Wales.

Mauro, P, N Sussman and Y Yafeh (2002): “Emerging market spreads: then versus now”, Quarterly Journal of Economics, May, 695-733.

McGuire, P and M A Schrijvers (2003): “Common factors in emerging market spreads“, BIS Quarterly Review, December.

Micu, M, E Remolona and P Wooldridge (2006): “The price impact of rating announcements: which announcements matter?” BIS working papers no. 207, June.

Moody’s Investor Service (2006): “Default and recovery rates of sovereign bond issuers, 1983-2005”, Special Comment, April.

Gande, A and D C Parsley (2005): “News spillovers in the sovereign debt market”. Journal of Financial Economics 75, 691-734.

International Monetary Fund (2005): Global Financial Stability Review, April.

Longstaff, F A, S Mithal and E Neis (2005): “Corporate Yield Spreads: Default Risk or Liquidity? New Evidence from the credit default swap market”, Journal of Finance 60 (5), 2213-2253.

Pan, J and K J Singleton (2006): “Default and recovery implicit in the term structure of sovereign CDS spreads”, working paper.

Reinhart, C, K Rogoff and M Savastano (2003): “Debt intolerance“, Brookings Papers on Economic Activity, 1, 1-74.

Remolona, E, M Scatigna, and E Wu (2007a): “Interpreting sovereign spreads”, BIS Quarterly Review, March.

Remolona, E, M Scatigna, and E Wu (2007b): "A Ratings Based Approach to Measuring Sovereign Risk", International Journal of Finance and Economics (forthcoming).

Standard and Poor's (2006): "2005 transition data for rated sovereigns", Commentary Report, February.

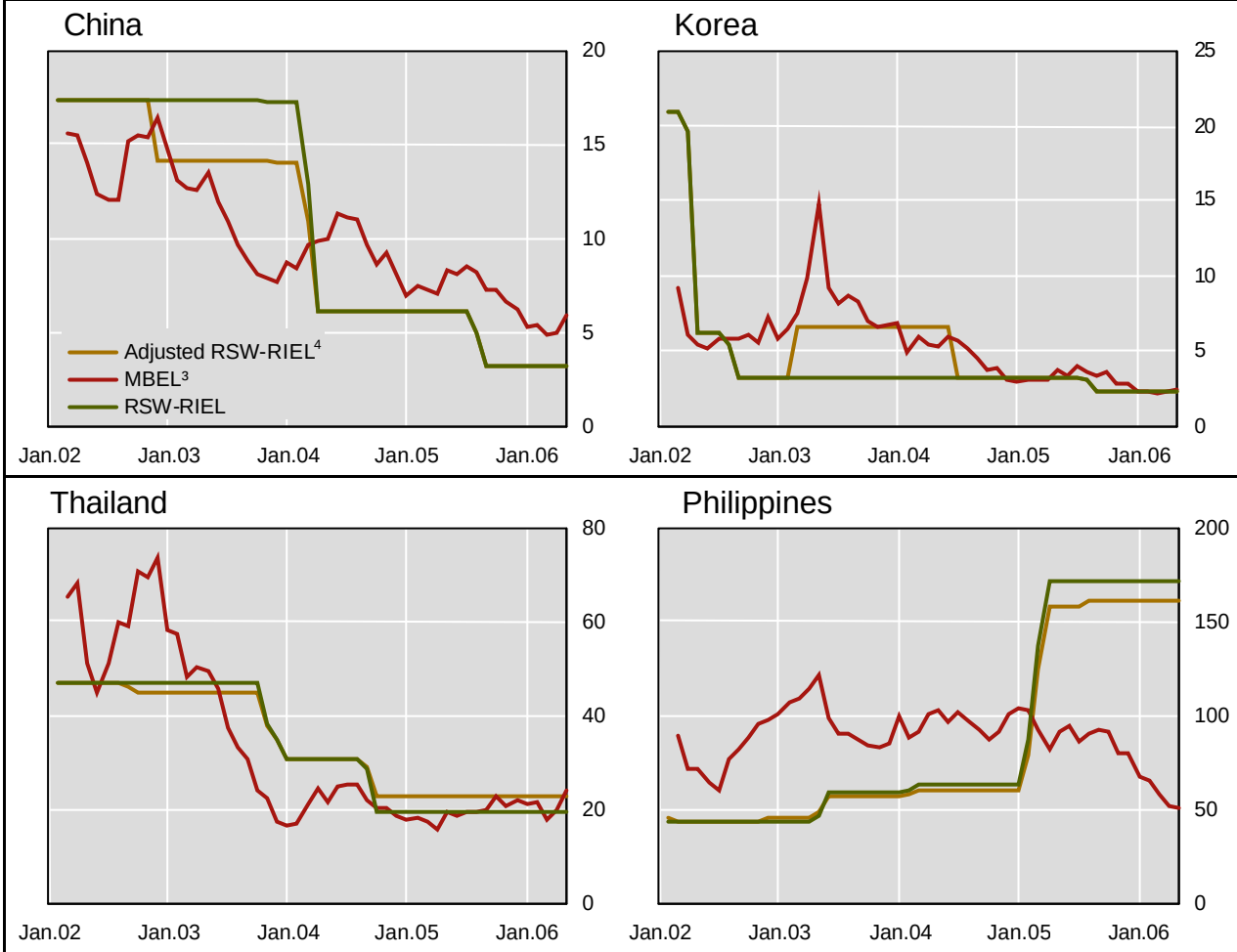
Sturzenegger, F and J Zettelmeyer (2005): "Haircuts: estimating investor losses in sovereign debt restructurings, 1998-2005", IMF Working Paper WP/05/137, July.

Tarashev, N, K Tsatsaronis and D Karampatos (2003): "Investors' attitudes towards risk: what can we learn from options?" BIS Quarterly Review, June.

Ul-Haque, N, M Kumar, N Mark and D Mathieson (1996): "The economic content of indicators of developing country creditworthiness", IMF Staff Papers, no. 43, pp688-724.

Zhu, H (2004): "An empirical comparison of credit spreads between the bond market and the credit default swap market", BIS Working Papers No 160, August.

Figure 1: Comparing measures for expected losses: RSW-RIEL[1,2] and MBEL[1,3]



[1] In basis points. [2] Remolona-Scatigna-Wu (2007) rating-implied expected loss. [3] Market-based expected loss. [4] Adjusted for outlooks and reviews.

Figure 2: CDS spreads and MBEL (In basis points)

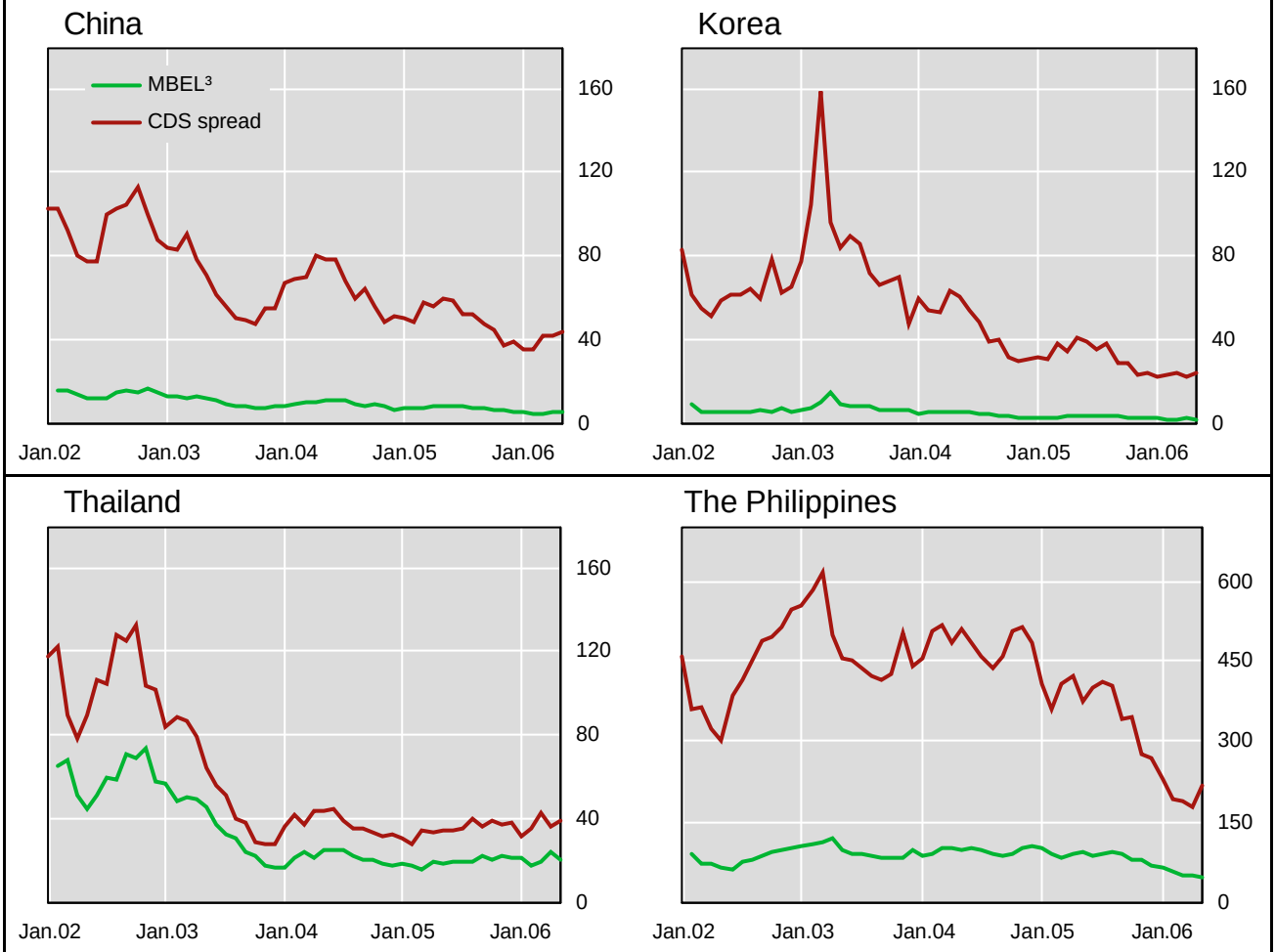


Table 1: What explains sovereign risk and what explains risk premia?

Explanatory variables	Dependent variables	
	Log MBEL	**Log risk premium[1]**
Fundamentals		
Lagged log dependent variable	0.855** {0.000}	0.708** {0.000}
Inflation rate	0.137* {0.097}	0.226 {0.154}
GDP growth consensus forecasts	-0.003 {0.149}	-0.007 {0.145}
Industrial production	0.000 {0.811}	-0.001 {0.463}
Foreign exchange reserves	-0.056** {0.010}	-0.175** {0.000}
Risk aversion		
VIX index	0.010** {0.002}	0.023** {0.000}
Risk appetite (Tarashev et al)	0.000 {0.980}	-0.043 {0.061}*
Hausman test	*120.81***** *{0.000}*	*166.422***** *{0.000}*
Adjusted R-squared	**0.99**	**0.97**

P-values are shown in parentheses, based on White cross-section standard errors. Sample period: Feb 2002- May 2006, monthly data frequency.

[1] Estimated using market based expected losses instead of rating implied losses.

Table 2: The influence of liquidity on sovereign risk and risk premia

Explanatory variables	Dependent variables	
	Log MBEL	**Log risk premium[1]**
Fundamentals		
Lagged log dependent variable	0.849** {0.000}	0.644** {0.000}
Inflation rate	0.962* {0.058}	0.731 {0.630}
GDP growth consensus forecasts	0.007 {0.380}	-0.025 {0.215}
Industrial production	-0.000 {0.587}	-0.001 {0.405}
Foreign exchange reserves	-0.099** {0.000}	-0.238** {0.000}
Risk aversion		
VIX index	0.010** {0.005}	0.023** {0.000}
Risk appetite (Tarashev et al)	-0.003 {0.849}	-0.044 {0.118}
Liquidity		
Net bond issuance	0.041* {0.056}	0.047 {0.241}
Adjusted R-squared	**0.99**	**0.97**

Note: P-values are shown in parentheses, based on White cross-section standard errors. Sample period: Feb 2002- May 2006, monthly data frequency.

[1] Estimated using market based expected losses instead of rating implied losses.

Table 3: Average pair-wise correlation coefficients for Sovereign Risk and Risk Premia

Panel A: Sovereign risk based on MBEL estimates

	Correlation with:				
	Intra-region	**Rest of the world**	**Asia**	**Latin America**	**CEE**
Asia	0.28	0.35			
Latin America	0.54	0.50	0.34		
Central and Eastern Europe	0.62	0.52	0.37	0.56	
Middle East and Africa	0.52	0.53	0.37	0.58	0.58
World	*0.49*	*0.47*			

Panel B: Sovereign risk premia

Asia	0.63	0.61			
Latin America	0.58	0.61	0.59		
Central and Eastern Europe	0.65	0.61	0.62	0.61	
Middle East and Africa	0.62	0.61	0.64	0.61	0.60
World	*0.62*	*0.61*			

Appendix A: List of sample countries			
Asia	*Central and Eastern Europe*	*Latin America*	*Africa and the Middle East*
China Korea Thailand Philippines	Bulgaria Czech Republic Hungary Poland Russia Turkey Ukraine	Brazil Chile Colombia El Salvador Ecuador Mexico Panama Peru Venezuela	Egypt Lebanon Morocco South Africa