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Overpricing in Emerging Market Credit-Default-Swap Contracts: Some Evidence from Recent Distress Cases

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Overpricing in Emerging Market Credit-Default-Swap Contracts: Some Evidence from Recent Distress Cases

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Abstract

Since recent debt restructurings that constitute credit events have been more frequent than outright defaults, sovereign bond prices may not collapse during distress. In this case, the likely high recovery values after restructuring suggest that the cost of credit-default-swap (CDS) contracts to the buyer (as measured by CDS spreads) may be higher than warranted. We estimate the extent of such overpricing by using the cheapest-to-deliver (CTD) bond as a proxy for the recovery-value assumption.

JEL Classification Numbers: F3, F34, G15, K33, K41

Keywords: recovery value; cheapest-to-deliver bond; credit-default-swap contract; ISDA

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I. Introduction

Recovery values on sovereign emerging market debt have not been subject to extensive research, largely owing to the changing nature of sovereign debt crises. Singh (2003) gives an overview of the approximate recovery rates from recent sovereign debt restructurings in emerging markets. Sturzenegger (2002) reviews the bond restructurings in Russia, Pakistan, Ecuador, and Ukraine. Since bond prices depend on the expected recovery value, it is possible to derive recovery values implied by market prices, especially during a crisis. Merrick (2001) shows the effect of Russia's restructuring terms on domestic bonds in 1998 on the implied recovery rates on Eurobonds in Russia and Argentina.

Singh (2004) uses spreads on credit-default-swap contracts (CDS) to estimate the implied default probabilities using the cheapest-to-deliver (CTD) bond to proxy for a stochastic recovery value. A CDS works as an insurance policy against the risk of an underlying borrower defaulting. Typically, an investor who owns a regular bond buys a CDS and makes fixed regular payments to the protection seller (i.e, the insurer). In exchange, the insurer guarantees payment of the whole amount (par value of the bond) upon default or a credit event (as specified in the contract). A CDS contract usually refers to a basket of deliverable bonds at the time of the contract, giving the protection seller a valuable option to deliver the cheapest bond upon default or a credit event. These CTD bonds—or deliverable bonds—are generally priced at a discount to other similar bonds owing to their illiquidity, currency denomination, legal jurisdiction, and other special features. In this paper, we use the CTD bond methodology to estimate the theoretical CDS spreads and compare them with market CDS spreads during distress in emerging markets.

II. CDS Spreads as a Measure of the Marginal Cost of Borrowing

We view CDS spreads as the marginal cost of debt, while the EMBI+ sub-index for a country is more representative to the average cost of traded debt. During distress, it is the marginal cost that is often more relevant; and although CDS spreads are a derivative of the cash bond market, their volatility and absolute levels may lead to sell-off in the underlying bonds.[2] This distinction is important since the EMBI+ sub-index has a much higher duration owing to the weighted average of all cash bonds (many of them including Brady bonds and 30-year bonds). The CDS spreads for a sovereign are usually quoted for no longer than a 5-year maturity; hence, their duration is much lower than for cash bonds. As Figure 1 suggests, CDS spreads could be a leading indicator, especially during a crisis when the marginal borrowing cost is more applicable to avoid restructuring or default, while the average cost is a better proxy for the sovereign risk in the absence of distress.[3]

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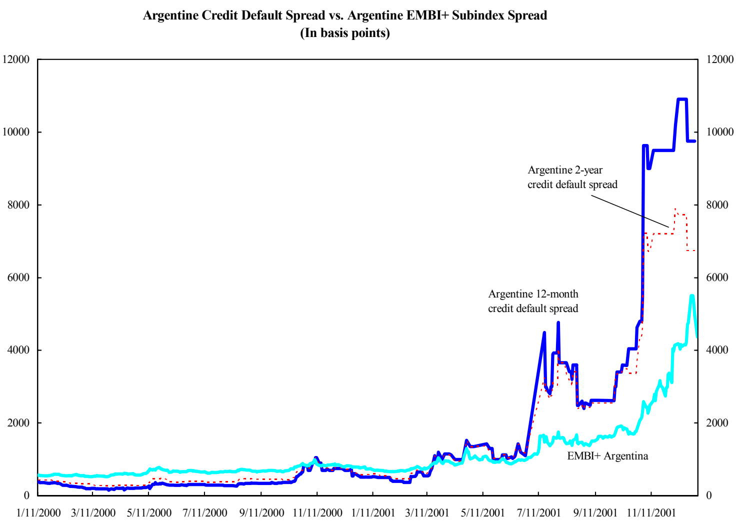
[2] See Singh (2004), pp. 110 (on "the tail wagging the dog").

[3] Other issues that may contribute towards the *basis* (i.e. difference between the marginal cost and average cost) include the repo market specialness, the number of CDS contracts, the variety of cash bond that are deliverable, etc.

Figure 1. Argentine CDS Spread Versus Argentine EMBI+ Sub-Index Spread



Sources: Merrill Lynch; and IMF staff estimates.

III. Restructuring as a Credit Event

Recent evidence suggests that the frequency of restructurings far outnumber actual defaults both in the high-yield market and in emerging markets. For the vast majority of CDS contracts, the restructuring term that is incorporated comes from the International Securities Dealers Association (ISDA) 2003 Credit Derivative definitions. A CDS contract can be exercised only if it is associated with a credit event. Events that fall under this definition include (a) change in interest rate, (b) change in principal amount, (c) postponement of interest or principal payment date, (d) change in ranking of priority, and (e) change in currency of payment of interest or principal in a non-permitted currency.[4] Rating agencies, however, may have slightly different perspectives. For example, Moody's views a restructuring, or distressed exchange that results in an economic loss to bond holders, or changes in interest and principal amounts, as a credit event (for their study on defaults).

Market convention and ISDA standards for a typical emerging market CDS contract *allow for restructuring as a credit event*. This is in contrast to high-yield CDS contracts.[5] In fact, according to a recent study by Fitch, "the lack of restructuring as a credit event for high-yield CDS contracts can have important consequences" in the context of relative value trading.

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[4] Permitted currencies are generally the G-7 currencies and also those Organization for Economic Cooperation and Development (OECD) currencies that carry a rating of AAA on their local currency debt (e.g., the Mexican *peso* and South Korean *won*, both member countries of the OECD, are not permitted currencies as the local currency debt is rated below AAA).

[5] CDSs may be too dear (the *Financial Times*, summary of Fitch Ratings report).

Steep price declines associated with a restructuring in the high-yield market is not deemed to be a credit event and thus cannot be protected against by buying a CDS contract. Interestingly, for emerging markets, a restructuring that constitutes a credit event allows protection buyers to enforce their option by delivering an acceptable bond to the protection seller.

In the context of emerging market, and following a credit event, the protection buyer can exercise the option to deliver an acceptable bond in a permitted currency to the protection seller. A voluntary debt exchange may preclude such rights, however, unless key economic terms (interest rate, principal amount,etc.) are altered during a debt exchange. Following a credit event, a protection buyer of a CDS contract can deliver any *pari-passu* bond in a deliverable currency. Typically deliverable currencies include the U.S. dollar, euro, yen, and in some cases the British pound, Swiss franc,and the Canadian and Australian dollars. Recent episodes of financial distress in Argentina, Uruguay and Brazil suggest that yen-denominated bonds are usually the cheapest-to-deliver (CTD) bonds, owing to their low coupons, comparably low liquidity, and regulatory arbitrage. Following a credit event, CDS protection buyers actively seek the yen bonds as deliverable obligations to CDS protection sellers to maximize their option value (see Box 1).

Box 1. Japanese Regulations and Accounting Arbitrage

Differential guidelines by Japanese regulators may provide room for accounting arbitrage. Japanese accounting rules have required banks and non-life-insurance companies to mark to market their portfolios since April 2002. However, the prefecture/locally run pension funds (such as those of Hokkaido and Saitama), and life-insurance companies (such as Nippon and Dai-ichi, or the Policeman Retirement Fund, and the Fisheries Association Fund) are not yet subject to the mark-to-market requirement. Market sources indicate that had it not been for such accounting arbitrage, it would have remained inexplicable why the local municipality pension fund of Hokkaido held a sizable amount of defaulted Argentine yen paper.

IV. Recovery Value in Theory and Practice

Recovery values in the aftermath of a restructuring announcement or during a debt exchange do not always go as low as 20 percent (or 25 percent) of face value, as is often assumed. We understand that CDS traders will quote prices (in spreads) that clear the market, with little regard to the fundamentals. In fact, the assumed recovery value is a constant. Subjective notions on the probability of default are factored by CDS sellers in their models and provide a benchmark for price quotations to CDS buyers.

Theoretically, CDS spreads are a joint function of *r* (recovery value) and *p* (probability of default), where both *r* and *p* are stochastic. Recent episodes of distress (that may have led to debt exchanges) have not resulted in bond prices collapsing to 20 or 25 cents on the dollar. In the case of Uruguay, the price of its lowest bond was in the 40 cent range—Table 1 for prices during the debt- exchange period. Uruguay's yen bond price (the 2.2 percent, 2006 issue) increased from 41 cents to 47 cents of face value on the dollar during the exchange *but remained the cheapest-to-deliver bond* of all deliverable bonds.[6] In the Dominican Republic's case, the cheapest-to-deliver bond has been near the 70 cent range (the 2013 bond). Brazilian bonds, during the 2002 crisis, did not go below 35 cents to the dollar.

Table 1. Prices of Uruguayan Bonds During the Debt Exchange

Coupon	Mat	Bid/Ask	Yield (percent)	
US$7.875	03	68.50/71.50	80.3	
EUR 7	05	59.50/61.50	32.0	
¥ 2.2	06	46.00/48.00	30.6	cheapest-to-deliver bond
US$8.375	06	63.00/66.00	23.3	
US$7	08	60.00/63.00	18.8	
EUR 7	11	51.00/52.00	19.0	
US$7.625	12	54.50/56.50	17.5	
US$7.875	27	49.00/51.00	15.8	

V. Methodology:—A Two-Step Process in Calculating CDS Spreads Using CTD Bonds

First, we use the CDS formulas to determine the implied probability of the traders when they price CDS contracts—Annex I. Although protection seller will seek the highest price to underwrite a contract, the seller's subjective probability is nevertheless relevant in quoting CDS spreads to a buyer. We thus use actual market prices of CDS contracts, measured in spreads, and the assumed recovery value of 20, in line with market practice, to calculate this probability of default. Since we argue that during distress the CDS market is very volatile

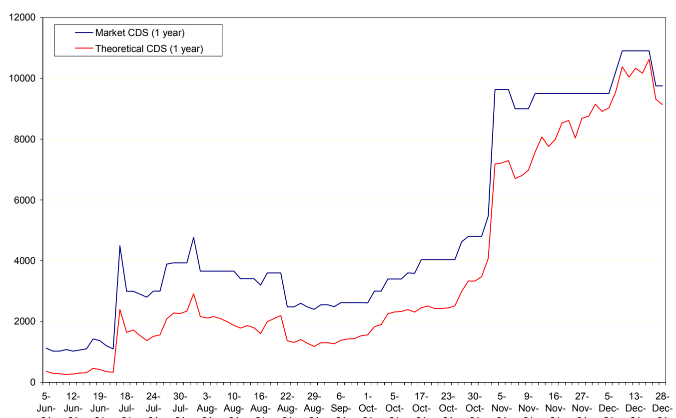
[6] During Uruguay's restructuring, bonds denominated in Chilean pesos, a non-permitted currency, were not acceptable for delivery—in fact there was no market for these bonds (and aside from "market quotes," these were considered inferior to the Japanese yen bonds). Similarly, the recent Colombian peso bond (11.75 percent coupon, due 2010) placed internationally in November 2004 will not be deliverable as a CTD during a credit event. Unless ISDA regulations change the definition of permitted currency, the CDS market will continue to look upon emerging markets as "original sinners."

and may disentangle from the cash bond market, this subjective measure of default risk is the only benchmark used by the underwriter to price CDS contracts.

Second, we derive theoretical CDS spreads by using the probability of default derived in step one and a stochastic recovery value approximated by the cheapest-to-deliver bond (CTD).[7] Duffie (1999) suggests that the offsetting features between a constant *r* and *p* in CDS contracts *"work poorly at high spread levels"* (i.e., during distress). The CTD measure for recovery value, *r*, is jointly stochastic with *p* and works well during distress (Singh 2004). We show the extent of possible overpricing between market CDS spreads and theoretical CDS spreads in Figures 2, 3, and 4. The two CDS spreads use identical probabilities of default but different recovery values. Although this does not follow common no-arbitrage arguments, the results give an idea about the sensitivity of CDS spreads with regard to the recovery value. Where a credit event is not associated with a significant decrease in cash bond prices—as it was the case in the Uruguayan exchange—such overpricing might be quite pronounced.

Intuitively, from a protection buyer's view, if prices do not collapse to 20 following a credit event, then the expected loss given default is reduced from par minus 20, to par minus x, where x > 20, as has been the case in recent distressed exchanges. Thus, the protection buyer should pay less for the CDS contract. Similarly, the seller of CDS contracts will pay out less to protection buyers since the CTD bonds that are received from CDS buyers are more valuable than 20 cents on the dollar.

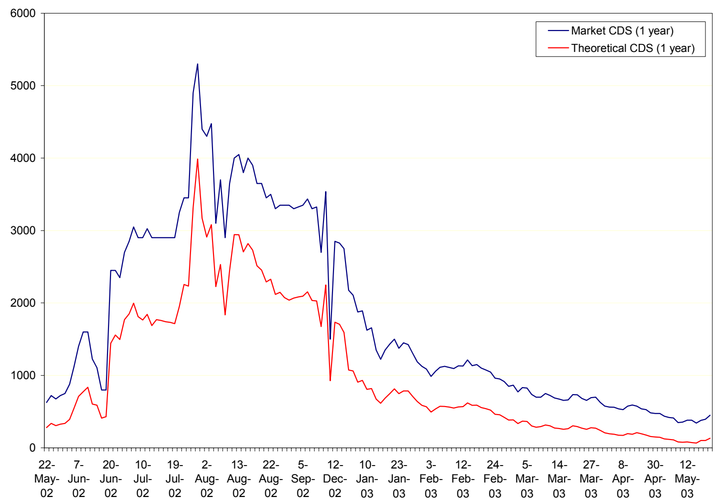
Figure 2. Argentina: Theoretical and Market CDS Spreads



Sources: Market prices; and IMF staff estimates.

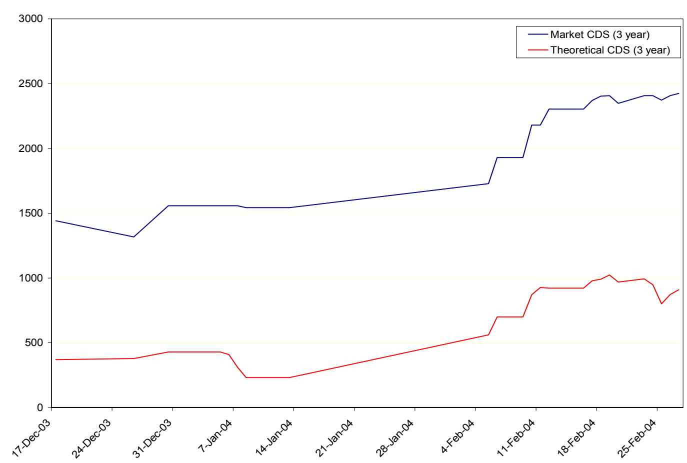
[7] See IMF Working Paper 03/242 for more details on approximating CTD for recovery value.

Figure 3. Brazil: Theoretical and Market CDS Spreads



Sources: Market prices; and IMF staff estimates.

Figure 4. Dominican Republic: Theoretical and Market CDS Spreads



Sources: Market prices; and IMF staff estimates.

VI. Conclusion

Although CDS contracts allow for restructuring as credit events, the trend towards painless restructurings should be reflected in CDS pricing**.** The above findings suggest that recent credit events on emerging market sovereign bonds have often been the result of a restructuring rather than an outright default. Although significant economic terms may be altered as part of the restructuring (e.g., deferring the maturity by four years with no change in interest or principal payments), bond prices do not collapse, since there is no interruption of payments, and there is no impasse between the debtor and the creditor. Recent episodes of distress that have led to debt exchanges have not resulted in bond prices collapsing to 20 or 25 cents on the dollar (e.g., Uruguay, the Dominican Republic). Emerging market CDS contracts would do well to account for such restructurings, which become more common as both the debtor and the creditor work toward a negotiated settlement rather than outright default.

ANALYTICAL BOX ON CDS PRICING

While CDS pricing was more art than science some years ago, the value of such a contract can be determined analogously to an insurance contract today: Regular premium payments by the protection buyer ("premium leg") compensate for a certain payment by the protection seller in the case of a predefined event ("protection leg"). The ISDA rules govern the definition of a 'credit event' for CDS in sovereign bond markets. Within 30 days of such an event, the protection buyer delivers the underlying bond to the protection seller and receives the full notional amount minus any accrued premium in cash. In sovereign CDS markets, normally any bond denominated in a G-7 currency is deliverable. This gives the protection buyer a right to exercise his option by giving the protection seller the so called cheapest-to-deliver (CTD) bond and collecting the par value.

For offering this kind of insurance, the protection seller gets compensated by regular payments of premia until the maturity of the contract or the credit event, whichever is first. At origination of the contract, the annual premium is chosen in a way so that the value of the CDS contract is zero. This premium is quoted and referred to as "CDS spread."

Following the definition from Hull and White (2000), let *p(t)* be the instantaneous probability that a credit event occurs at time *t*. The risk-neutral probability of a credit event occurring until time *T* is therefore $1-\int_0^T p(t)dt$. Since payments of the CDS premium *s* normally occur quarterly, $u(t)$ denotes the today's present value corresponding to annually 1$ of these payments until time *t*. In order to account for an accrued but not yet paid premium, $e(t)$ stands for the present value of an accrual payment at time *t*. From this the present value of the premium leg *g* can be calculated:

$$g(s,p(t)) = \int_0^T sp(t)[u(t)+e(t)]dt + s\left(1-\int_0^T p(t)dt\right)u(T)$$

This formula consists of two summands: the first one is the present value of the payments of premia due plus any accrued premium in case of default before maturity *T* of the underlying bonds. The second is the expected present value of premia in case of no default.

If *r* is the fractional recovery value at time of the credit event, considering any accrued interest $A(t)$ on the deliverable bond, and the contract is settled immediately, a good approximation for the protection leg *h* is given by

$$h(s,p(t),r) = \int_0^T [1-r(1+A(t))]p(t)v(t)dt\ .$$

The fair CDS spread $\bar{s}$ is determined so that the value of the contract is zero, i.e. the value of the premium leg equals the value of the protection leg:

$$g(\bar{s}, p(t)) = h(\bar{s}, p(t), r) .$$

To solve for the fair CDS spread $\bar{s}$, two parameters (besides the risk free discount rate) need to be known: the risk-neutral default rate, *p*, and the recovery value relative to par, *r*. Although both parameters are actually stochastic and vary over time, for the sake of simplicity they are often assumed to be deterministic and constant.

Since the bond price is a function of exactly these two parameters *p* and *r*, too, a common approach is to assume some value for *r* and solve the bond price formula, using market price data, for the implied probability *p*. A common value for the assumed recovery rate is thereby 20 or 25 percent. However, for bond prices close to par this assumption does not matter very much: any underestimation in *r* will lead to a lower implied *p*, while an overestimation of *r* gives a higher *p*. Using these values in the CDS formula and solving for the fair CDS spread $\bar{s}$, the difference will be negligible because the biases offset each other. This stems from the effect that both the bond value and the CDS spread are approximately linear functions of the recovery fraction when the bond price equals its par value and the default probability is very small.

Mathematically, it can be shown that the yield spread of bonds trading at par is the product of the instantaneous default probability *p* and the loss given default, i.e. (1 - *r*). This is always the case when assuming that the recovery is some fraction of the pre-default market value, the commonly used “recovery of market value” or RMV assumption. Under the previous assumptions, the trading price V with respect to 1$ face value of a bond with *M* semiannual payments of a coupon *c* until maturity is

$$V = \frac{c}{2}\sum_{j=1}^{M} v(t_j)\exp(-p(1-f)t_j) + v(t_N)\exp(-p(1-f)t_N),$$

where *f* is the fractional recovery of market value. It is intuitively appealing that the RMV concept equals the concept of “recovery of face value” (RFV) if the bond is trading at par. In this case, *f* equals *r*. Remember that the *r* used for calculating CDS spreads needs to follow the RFV concept since in case of default the protection seller does not reimburse the pre-default bond value but the face value.

As Duffie (1999) correctly states, the distinction between *f* and *r* does not matter under the simplifying conditions of low default risk and bond prices at par. This is obvious since the above formulas for the fair CDS spread can be approximated by the product of the instantaneous default probability and the loss given default, as shown—for instance—by Longstaff et al. *(forthcoming)*. Any bias created by estimating *p* from bond prices under some artificial assumption of *r* will cancel out when using both parameters for the CDS calculation.

This offsetting mechanism does however not work at high default risk when cash bonds trade significantly below par. Applying the RMV and RFV concepts to bond prices now yields different parameter values. Only if zero recovery is assumed, both the RMV and the RFV concept are similar because $(1 - f)$ in the RMV formula will become one. Applied to bond price data, both concepts would yield the same implied default probability. Using these parameters in the CDS formulas will result in very different fair CDS spreads, depending on the initially presumed value of r. Uncertainty about the loss given default translates into high uncertainty about the fair CDS spread. This effect is most pronounced at very high default risk and CDS with longer maturities.

This paper, however, relies on CDS quotes instead of cash bond prices to estimate the implied default probability. Given market quotes of CDS, and assuming that these were priced fairly under the assumption of r = 20percent, the above CDS equation can be solved for the CDS-implied default probability, $\hat{p}(t)$. For the illustrative purpose of this article, we assume that this is what traders really believe to be the risk-neutral probability of default, maybe due to rules of thumb or from experience in previous crisis cases. When using this probability but replacing the recovery rate r by the current dirty market price of the CTD—reflecting the prevalence of soft restructurings as credit event—we yield CDS spreads as shown in Figures 2 to 4.

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