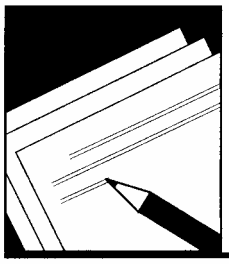

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IMF Policy Discussion Paper

Credit Derivatives in Emerging Markets

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IMF Policy Discussion Paper

International Capital Markets

Credit Derivatives in Emerging Markets

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Abstract

Credit Derivatives are securities that offer protection against credit or default risk of bonds or loans. The credit derivatives emerging market has grown rapidly and credit derivatives are widely used. This paper describes the emerging credit derivatives market structure. The current market activity is analyzed through elementary pricing dynamics and the study of the term structure of default risk. Focusing on the performance of credit derivatives in stress situation, including legal and market risks, we discuss the potential consequences of a debt restructuring in a large emerging market borrower. The contribution of credit derivatives to the risk sharing in emerging markets is also examined.

JEL Classification Numbers: F3, G1

Keywords: Emerging Markets, Derivatives, Sovereign Debt, Debt Restructuring

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I. INTRODUCTION

Credit Derivatives are securities that offer protection against credit or default risk of bonds or loans. The default swap is the canonical credit derivative and the basic building block of the credit derivatives market. A default swap offers its buyer a protection against the loss of a reference asset value following a credit event (default, restructuring...). The pay-offs are summarized by the following figures:

Periodic Payment

Protection Buyer ⟶ *default swap spread* ⟶ Protection Seller

Following a credit event:

If cash settlement:

Protection Buyer ⟵ *100-Recovery Value of underlying securities* ⟵ Protection Seller

If physical settlement:

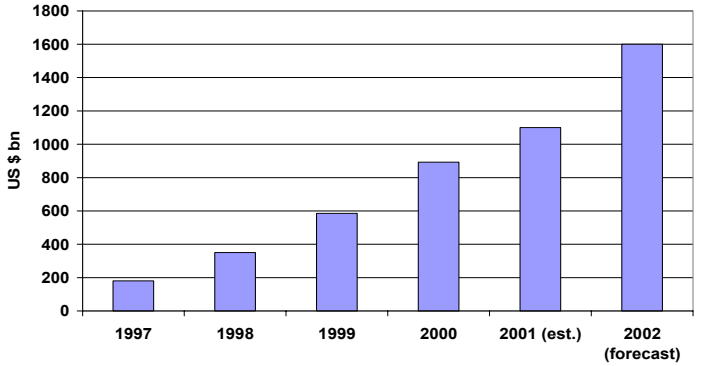
Protection Buyer ⟵ *100* underlying securities ⟶ Protection Seller

In economic terms, the purchase of a credit protection transforms a risky bond into a risk-less asset. Selling (resp. buying) a protection is equivalent to have a long exposure on the (resp. short) bond market. However a position in bonds has to be funded via the repo market whereas a default swap position is unfunded. Therefore, by the *No Arbitrage Condition,* a default swap can priced using the bond over Libor spread and the repo rate. However, others factors such as liquidity or, in case of physical settlement, the option to deliver the cheapest bond, will also affect the pricing of credit derivatives.

Theoretically, credit derivatives constitute a new class of assets designed to trade default risk on a large range of maturity with no collateral constraint. Nevertheless, the absence of a secondary market, the global lack of liquidity and the hedging using the repo market, are mitigating the potential efficiency gains derived from the introduction of credit derivatives.

Since 1996, Credit Derivatives have experienced a very rapid growth. Figure 1 presents the development of the global derivatives markets based on a survey completed by the British Banker association (B.B.A).

Figure 1: Global Credit Derivatives Market (notional amount of contracts)



The corporate sector share of the credit derivatives market is estimated at 80% and constitutes essentially a segment of the high yield fixed income market in developed economies. By contrast, the sovereign sector (20%) is mostly composed with credit derivatives on emerging sovereign bonds.

The standardization of the legal documentation has been a driven force in the development of the credit derivatives market. Based on the 1999 Credit Derivatives Definitions issued by the International Swap and Derivatives Association (ISDA), the new ISDA confirmation form has turned default swaps into plain vanilla derivatives products, even if some legal risks persist.

Section II focus on the general structure of the credit derivatives emerging market and describes the main products and participants. Section III analyzes the current market activity through two main approaches: the study of the bonds-credit derivatives basis and the default probability term structure. Section IV examines the performance of credit derivatives in stress situation evaluating legal, economic and market risks. As an application, we study the consequences of a debt restructuring in a large emerging market borrower on the credit derivatives market.

Data, quotes and other background elements used in this paper come from various sources, the British Bankers Association (B.B.A), the International Swap and Derivatives Association (I.S.D.A) and major investment banks active in credit derivatives. Discussions with credit derivatives specialists in the same institutions and banks have been extremely useful on major points throughout this paper.

II. EMERGING CREDIT DERIVATIVES MARKET STRUCTURE

A. A brief history.

The Credit Derivatives market really started in 1996. At the beginning, many financial institutions were concerned about their credit risk exposure and viewed credit derivatives as a useful tool for risk management. The credit derivatives market was then seen as a complement to the loan securitization markets. Rapidly, the credit derivatives market experienced an independent rapid development and became simply a key place to hedge and take credit risks on corporate and sovereign debt. The corporate sector represents less than 5% of the credit derivatives emerging markets and is concentrated on a very few number of large state owned companies (see box below for a more detailed description).

The emerging credit derivatives market took off during the second half of 1997, contemporaneously with the Asian Crisis. The absence of a standardized documentation, however, slowed down its development until the publication of the 1999 I.S.D.A credit derivatives definitions. During the Russian bond default in 1998, credit derivatives have been generally efficiently triggered, but some legal documentation problems have been highlighted. The 1999 I.S.D.A. definitions have reduced the causes of legal disputes. For example, Ecuador quasi-voluntary bond exchange (1999) was recognized as a credit event and triggered

contingent default swap payments without any legal problems. Similarly, all market players agreed that the recent Argentina debt swap (2000) did not constitute a credit event.

The recent turmoil in Argentina reduced the activity on the emerging sovereign credit derivatives market, but market players expect this market to resume a rapid growth in the following five years. As many financial institutions are now able to validate their internal risk model for prudential regulation, credit derivatives will be more widely used for risk management in banking books. The development of the relative value trading should be a source of increasing liquidity. It is however difficult to anticipate, in the near future, the emerging default swap market becoming a fully independent and liquid market such as the interest swap market. The evolution of liquidity in emerging market credit derivatives will most likely follow the evolution in the liquidity in the bond and repo emerging market.

B. Emerging credit derivatives: the regional partition

The most recent estimates on the actual size and regional partition of credit derivatives in emerging markets have been done by Deutsche Bank (DB) by cross-checking the B.B.A. estimates and extrapolating from the actual size of their trading books. Based on their estimates, the overall size of the market is US$ 200-300 billion in notional amount of contracts which breaks down on a regional basis to approximately: 50-60% Latin America, 23-30% Eastern Europe, 10-20% other.

Deutsche Bank establishes a ranking of countries according to liquidity levels, based on the frequency of trades in the default swap market. Note, however, that this ranking does not take into account that Argentina has not traded since mid-June, and that the trading activity in Turkey has been very low. Not surprisingly, countries in the "most liquid" segment have a large bond market.

Table 1: Liquidity Levels

Most Liquid	Less Liquid	Sporadic Activity
Argentina	Bulgaria	Chile
Brazil	Croatia	Ecuador
Mexico	Peru	Ivory Coast
Russia	Korea	Morocco
Turkey	Thailand	Kazakhstan
Columbia		Lithuania
Venezuela		Tunisia
South Africa		Romania
Philippines		

source: Deutsche Bank estimates August 2001

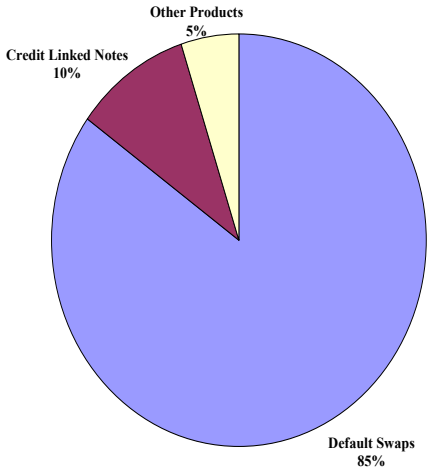
C. Key Credit derivatives products in emerging markets

As shown on figure 2, default swap is the dominant product in emerging market. By comparison, default swaps represent less than 40% of the global credit derivatives markets.

- **Default Swaps.**

As described in the introduction, the default swap is the cornerstone product in the credit derivatives emerging markets, accounting for 85% of outstanding notional according to Deutsche Bank. Default swaps are offered on a maturity ranging from 1 to 10 years. The most active segment of the market is, however in the 1 to 5 years range. The underlying obligation category is generally "bonds" and sometimes "bonds or loans". Even if default swaps are unfunded instruments, a collateralization is sometimes required, especially for hedge funds.

Figure 2: partition by products in emerging markets



- **Credit Linked Notes**

Credit Linked Notes are economically equivalent to default swaps and are designed for investors that want to sell protection via a cash instrument. The protection buyer issued a note at par related to a reference credit – a set of underlying assets-, generally via a special purpose vehicle. The note is pays a floating coupon Libor + credit spread. If there is a default on the reference credit, the issuer defaults on the note and deliver the underlying assets. The only difference with the default swap is that the default payment is, in a sense, prepaid by the protection seller and reimbursed if no credit event occurs. Credit Linked Notes account for 5-10% of the emerging credit derivatives market.

- **Other Products**

-First Default Basket Products.

The design of this product is similar to the design of a default swap or credit link notes, but the protection is not against the default of a single name, but rather against the first default of a basket of names. The pricing depends on individual default risks as well as on default correlations. These products are tailor made for clients and account for a marginal but growing share of the market.

-Synthetic Collateralized Debt Obligation (CDOs).

The CDOs entered the emerging market in 1999. They combine securization and credit derivative technology to tranche a pool of underlying default swaps into different classes of credit risk. The issuer of CDO notes purchases protection on the reference pool either through a default swap or by selling credit linked notes. The different tranches carry rating ranging from triple-A to single-B. An equity tranche is unrated and represents the "first loss" in exchange for the highest return. A default swap, made with an external counterparty, represents the "super senior" tranche and covers a certain percentage of the reference portfolio. The proceeds of the

notes are invested in a pool of highly rated government securities. Principal and interest is paid to the highest rated notes first, while any losses are borne by the more junior tranches.

THE EMERGING CORPORATE CREDIT DERIVATIVES MARKETS*

In emerging markets, the corporate credit derivatives markets essentially take two broad forms:

The first is the select names that trade in the more liquid default swap dealer market. This is primarily a sovereign risk market, but from time to time (very infrequently) some top tier corporate names will trade. Examples of names include Cemex, Pemex, Telmex, Enersis, Endesa, BNDES and Petrobras. Trading activity in these names is very sporadic and tends to only coincide with specific dealer axes and/or client demand. The primary reason for this is the lack of suitable corporate bonds available in the cash market to hedge protection positions. There is rarely active two way pricing on the broker screens for these credits.

Historical data for this market is very hard to come by, but in general one could estimate that trading activity on these names make up no more than 2-5% of the total volume of Latam default swaps traded. The names that trade the most are the Mexicans, primarily Telmex and Cemex. The Chilean names trade more as a proxy for sovereign risk, given the lack of Chilean sovereign bonds in the cash market. There are no EEMEA or Russian corporate credits that trade in the default swap broker market.

The second and more widely used method of trading corporate credit risk is through credit linked notes and other more structured forms of credit derivatives. These types of trades are primarily client/investor driven, in most cases structuring products which allow investors to go synthetically long a corporate credit risk. Frequently investors are the sellers of credit protection and the dealers are buyers of credit protection on the underlying risk. These trades are attractive for investors in that the investor may not be able to purchase the corporate credit outright in the cash market (could be due to e.g. internal restrictions or lack of bonds in the market) and also a CLN may provide a higher yield relative to a comparable bond. The real added value provided by dealers such as DB in this market is that one can source illiquid, exotic corporate credit risk and repackage it into a listed, Euroclearable CLN with the DB name attached to it. The documentation on these trades will tend to be more tailored to the specific underlying asset. Here, the universe of credits is much broader (not just the top tier names) and will depend on specific investor risk tolerance and comfort with a particular credit. It also involves much more in-depth fundamental credit analysis to effectively price the risk and get investors comfortable with the credits. Most investors dealing in this asset class are looking for attractive yield pick-up over the sovereign from a corporate with a relatively solid credit story. These products are covering all EM regions and across a broader credit rating range. Given the highly proprietary nature of this market, it is impossible to estimate the size and geographic breakdown of this activity

*based on a conversation with Chris Wilder, Deutsche Bank.

D. Key players

Quantitative data about the role of different types of players in emerging market credit derivatives are not available. Aggregate credit derivatives data, produced by the B.B.A. survey, are too biased towards the corporate sector (80%) of the market to offer a faithful description of the emerging sovereign sector. Generally, the set of players in emerging market credit derivatives is simply a subset of the set of players in emerging market sovereign bonds.

- **Hedge Funds**

According to the main broker-dealers, hedge funds are active participants in emerging markets as end users of default swaps. By selling protection via default swaps, they are able to gain leverage returns through unfunded instruments. However, the activity of hedge funds has largely switched from macro-directional strategies – via outright default swap seller positions– to relative values strategies, including cash vs. credit derivatives basis trade, as well as arbitrage trades on the slope of the default swap curve. Hedge funds are also active in CDOs, usually by buying highly risky junior tranches.

- **Mutual Funds/ Pension Funds**

Mutual funds that manage emerging market fixed income portfolios and pensions funds with emerging markets exposure represent a growing share of the market. They are natural sellers of protection by buying credit linked notes and tranches of CDOs. The positive basis between default swaps and bonds enable them to replicate and outperform emerging market indices, especially if they are not too sensitive to liquidity levels, Funds managers are also buyers of protection to hedge spread and default risk inherent in long bond positions.

- **Banks**

-Broker-dealer activity and trading books.

Broker dealers, which provide the market with liquidity, are mainly the major investment banks involved in the emerging bond market (Deutsche Bank, JP Morgan-Chase, Salomon-CitiBank, etc.). They provide also added-value services by structuring and distributing portfolios of credit risk.

In the credit derivatives emerging market – unlike in the swap market – broker-dealers and trading activities are much interconnected. Broker-dealers are structurally sellers of protection (i.e. long) and retain risk that is actively managed in credit derivatives trading books. The trading desks will manage maturity mismatches and basis risk.

-Banking books.

Banks are buying credit protection to reduce country credit exposure, to free up credit lines, and to improve balance sheet efficiency. As these banks develop and validate internal risk systems capable of offsetting loan portfolio credit risk with the purchase of credit protection, and bank accounting and regulatory standards continue to evolve, major banks are expected to become more significant users of credit derivatives.

III. THE CREDIT DERIVATIVES EMERGING MARKET ACTIVITY

The credit derivatives market activity can be observed by two main approaches. The price mechanics can be studied through the dynamic evolution of the **basis**. The basis is defined as the difference between the default swap spread and the bond spread over Libor for a similar duration. Default swaps spreads can be also used to analyze the term structure of default risk. Because default swaps are offered in the same maturity range for all countries (1,2,3…10 years), we can then very easily compare default risk across countries. Default swaps spreads and bond spreads used in those two techniques are compiled in the database described below.

A. Credit Derivatives Emerging Markets Database

The Database reports daily indicative market levels for one to ten year default swaps and US$ denominated obligations for the following countries:

-Western Hemisphere: Argentina, Brazil, Columbia, Mexico, and Venezuela
-Asian Pacific: Korea, Philippines, Malaysia, and Thailand
-Europe: Russia, Turkey.

Here is a sample of the database for Argentina:

Argentina (08/06/2001)

Default Swaps Maturity	**1 year**	**2 year**	**3 year**	**4 year**	**5 year**	**7 year**	**10 year**						
Modified duration[1]	0.76	1.34	1.80	2.13	2.43	2.89	3.32						
Default Swap Spread – Bid (bps)	3600	3180	2930	2785	2640	2430	2270						
Default Swap Spread – Ask (bps)	4600	3680	3330	3085	2940	2730	2470						
BONDS	**FRB**	**Y02**	**Y04**	**Y05**	**Y08**	**Y09**	**Y11**	**Y18**	**Y14**	**Y19**	**Y16**	**Y26**	**Y29**
Modified duration	1.27	1.86	2.89	3.16	3.71	3.83	3.87	4.31	4.51	4.76	4.89	5.14	5.22
Bond Spread over Libor (bps)	2709	2427	1962	1868	1860	1793	1770	1593	1621	1564	1621	1275	1357

Source: Salomon Smith Barney

Bid-Ask spreads in default swaps are usually between 40 and 100 bps, but they can be up to 300-500 bpd for illiquid names, and when the bonds spread are very large. In Argentina, the extreme 1000 bps spread on the one-year default swap indicated that in fact there is no market interest for buying protection on Argentina.

The database has been initiated in June 2001. The frequency of the data is weekly and daily for the most active markets. This database has a two-tier function. The first objective is to follow jointly the credit derivative and the cash market. The second objective, to examine medium and long run trends in activity and price dynamics, is left for future investigation.

[1] for a given security, the modified duration tells how the price changes given a change in yield.

B. Default Swap and Bonds Emerging Markets Analysis

- **Methodology**

If one disregards counterparty risk, buying complete credit protection via a default swap transforms a risky obligation into a riskless obligation. Then. by the *No-Arbitrage condition*, the return of the protected obligation equals the risk-free interest rate. The funding cost or repo rate is also necessary to determine the break-even default swap price:.

For example, assume that your risky obligation has a return of Libor + s. where Libor is the risk-free interest rate. In order to fully hedge your credit risk, one must buy a default swap for a similar duration. The premium of this default swap is ds. In addition, one must finance the long position via repo or by an alternative source of funding; the cost of funding is set at Libor +f.

The flows of the hedged buyer portfolio can then be summarized as:

Then by applying the *No Arbitrage Condition*, one determines the break-even rate for the buyer of credit protection at the inception of the default swap:

$$\textbf{LIBOR+s –(LIBOR+f+ds) = LIBOR} \Leftrightarrow \textbf{ ds=s-f} \quad \textbf{(1)}$$

Similarly a seller of protection can fully hedge by selling the bond. To do so, the seller must borrow the bonds or lend money in a repo agreement at a rate **LIBOR+f:**

Then, also by the *No Arbitrage Condition*:

$$\textbf{Ds+LIBOR+fs-(LIBOR+s)= LIBOR} \Leftrightarrow \textbf{ ds=s-f} \quad \textbf{(2)}$$

If the buyer of protection is funded via the repo market, the market clearing condition of the repo market gives **f=fs.** However, if the protection buyer has a very good rating, he can finance his position at a lower rate than the repo rate.

There are gains from trade in a credit Derivative transaction between a protection buyer with a low funding cost and a protection seller with a high funding cost, who can be exposed to credit risk through an unfunded position.

When repo rates are "**specials,** i.e. especially low because most of the traders want to short the bonds, the price of the default swap is driven upwards: the protection buyer can pay a more expensive premium because the obligation is cheap to fund, and the seller can ask for a higher price because of the higher cost of shorting the bonds.

The difference between the default premium and the spread over LIBOR is called the **Credit derivatives-cash Basis.**

Basis=ds-s=f

By (1), **Basis=ds-s=f** and the Basis is simply the break-even funding Libor spread. However other elements affect the Default **Swap-Cash Basis**:

- **Liquidity**: For high default risk countries (i.e. Argentina and Turkey at present), there are very few protection sellers. The most liquid segment of the market include countries that are not facing an intrinsically high risk of default in the short run, but that may be affected by contagion if Argentina or Turkey defaults. For example, Brazil and Mexico have traded in July-August 2001, but almost no trade occurred in Argentina during the same period.

-Cheapest- to-deliver option: In a default swap with physical settlement, in case of a credit event, the protection buyer has to deliver obligations in the set of deliverable obligations for the reference credit. Therefore, he will try to maximize his pay-off by delivering the cheapest deliverable obligation.

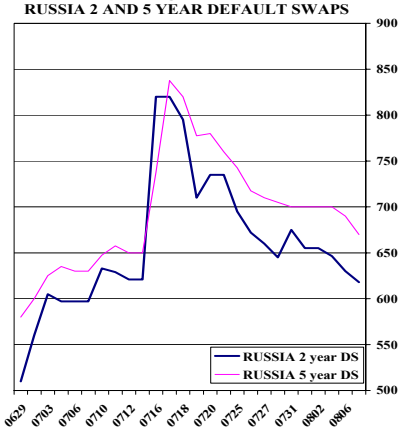
-Pay accrual at default: In an event of default, plain vanilla default swaps pay accrued interest whereas a holder of bonds typically will not receive accrued interest.

- **Applications**

-Recent Activity in Credit Derivatives Emerging Markets (June 27- August 06).

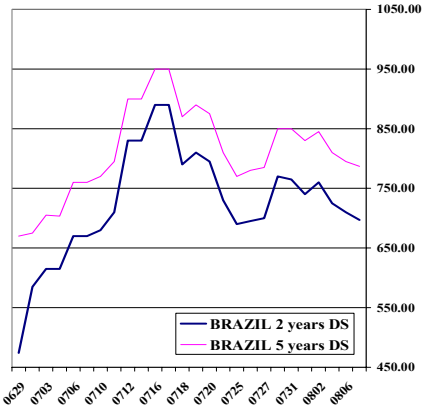
In the global economic context, the main features are the slow-down of the US economy and rising concerns about possible defaults in Turkey and in Argentina. Figure 4a and 4b present the evolution of default swaps in Brazil and Russia.

Figure 4a
RUSSIA 2 AND 5 YEAR DEFAULT SWAPS



Brazil and Russia default swaps widened sharply in July in line with dramatic increase in Argentina default risk. Russian 2 and 5 year default swap spreads increased by 300 bps before going back down gradually to original levels. Brazilian default swaps increased more gradually between the end of June and mid-July with a rapid flattening of the default spread curve. 2 and 5 years default swaps

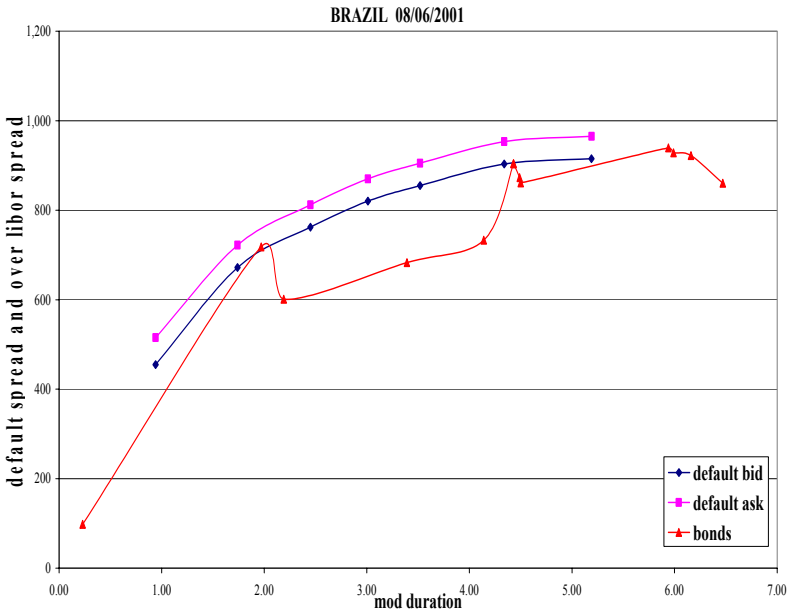
Figure 4b
BRAZIL 2 AND 5 YEAR DEFAULT SWAPS



culminated at 900 and 950 bps and then tightened, as Argentina pressure eased, but remained significantly above original levels. Mexico default spreads increased modestly by 40 bps and Korean default spreads stayed on the same level. Overall, the contagion risks associated with the rising concerns about the sustainability of the debt of Argentina seem to have been limited both geographically and in time.

-An example of the basis analysis: Brazil

Figure 5



In Figure 5, the traditional yield Curve is compared to the Bid and Ask Default curves. Default swaps are indicated above the curve, except around the 2 year and 5 year points, which correspond precisely to actively traded maturities. Bid-Ask spreads on Brazil are ranging between 40 and 60 bps.

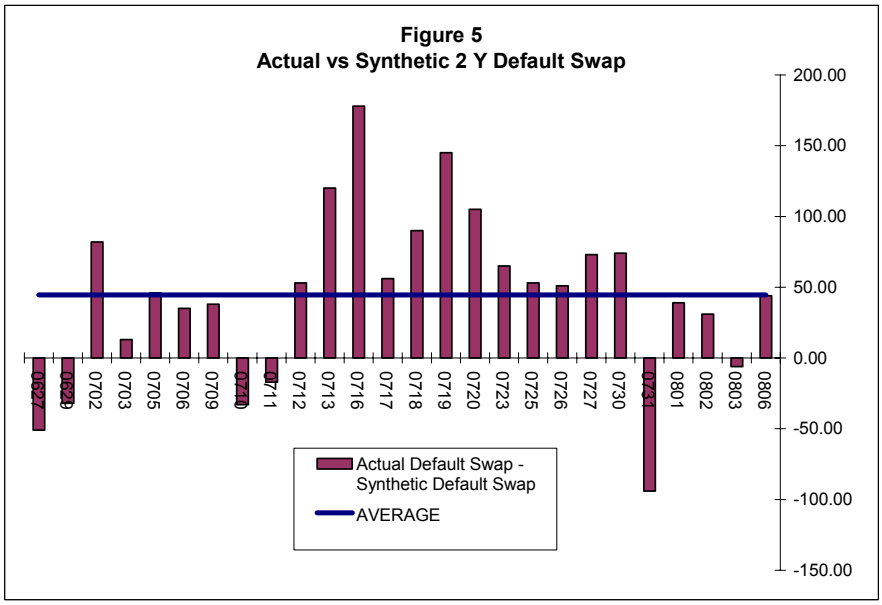
From (2), we can replicate a long position in a 2 year default swap by a short position in the Brazil EI Bond via the REPO market. The EI bond has a modified duration of 1,9 and the 2 year default swap of 1,8. In this way, a **synthetic default swap** is created with a market value according to (2):

$$Ds^{el}=s^{el}-f^{el}$$

where s^{el} is the spread over Libor of the EI Bond and f^{el}, the difference between the Libor rate and the repo rate.

In the absence of any market imperfections, the actual price of the default swap and the price of the synthetic default swap should be equal. Figure 5 presents the difference between the actual default swap and the synthetic 2 year default swap over the period June 27-August 06.

On average, the actual default swap is trading 40 bps above the synthetic default swap created by shorting the EI Bond. This



difference can be explained by the lack of liquidity in the default swap market and the value of the embedded delivery option. It is also implicitly reflects the repo market risks. In trading book, short position in default swaps are usually covered by short position in cash via the repo market. On the repo market, the opportunity cost of borrowing bonds may surge if the bonds become "special", i.e there is an excess demand to borrow bonds. In the extreme case, the liquidity on the repo market may vanish, making the hedge of credit derivatives impossible[2]. Obviously, those risks are taking into account into the pricing of credit derivatives, and have a positive impact on the basis.

C. Default Probability Term Structure and applications.

With an estimation of the recovery value of underlying bonds, one can easily derive, from the default swap curve, the term structure of default probability. In this section, we compare the default risk term structures in the two largest emerging credit derivative markets: Argentina and Brazil. Details of the methodology are exposed in Annex A.

- **The term structure of default probabilities.**

From the default spread curve, we construct, by *no arbitrage condition,* the forward default spread curve. The forward default spread reflects the conditional risk of default for a given period. Therefore, we apply the *risk neutral valuation principle* to obtain the conditional 6-months default probabilities and then the annualized conditional probabilities of default. By combining the annualized conditional probabilities, we derive:

-The Survival Probability: the probability of a default of the bond between now and a given date.
-The Cumulative Default Probability: the probability that the bond default between now and a given date.
-The Probability of a default occurring precisely in any one year time interval.

- **Applications: Argentina and Brazil (08/03/2001)**

As shown on Figure 6 and Figure 7, both Argentina and Brazil default risk profiles display clear differences, whether considered at one year of horizon or at medium run horizon. Argentina one year default probability is five times greater than Brazil. After the first year, the conditional probability

Figure 6
Argentina : one year conditional default probabilities

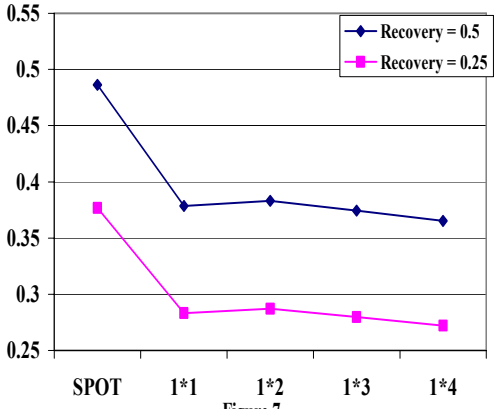
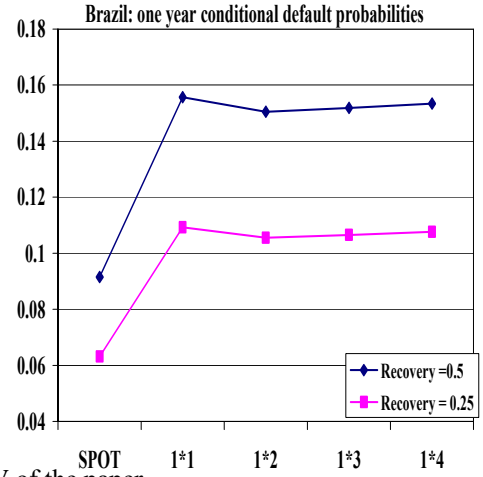


Figure 7
Brazil: one year conditional default probabilities



[2] the risk of "short squeeze" will be analyzed in more details in Section IV of the paper.

of default in Argentina is reduced by more than 50% and stays roughly constant up to year 5. In contrast, of Brazil conditional default probability almost doubled between the first and the second year, and stays also more or less constant during the next four years. In a sense, the market has a two-tier view of default risk: a specific one year view and a medium run view for the following four years.

Looking at cumulative default probabilities (Figure 8), Argentina clearly looks much more risky than Brazil. The probability that a default will occur in Argentina in the next five year is as high as 80% as compare to 40% in Brazil. However the probability of a default between year 4 and year 5 is almost the same in Brazil and Argentina (Figure 9). While a default in the short run is much more likely in Argentina, than in Brazil, anticipations of a default occuring in Argentina and Brazil in 4-5 years are very similar.

Figure 8
Cumulative Default Probabilities

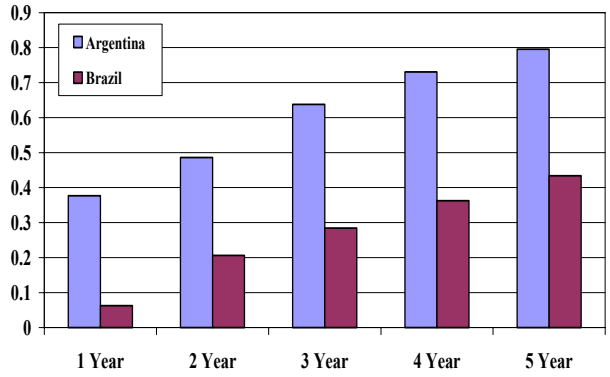
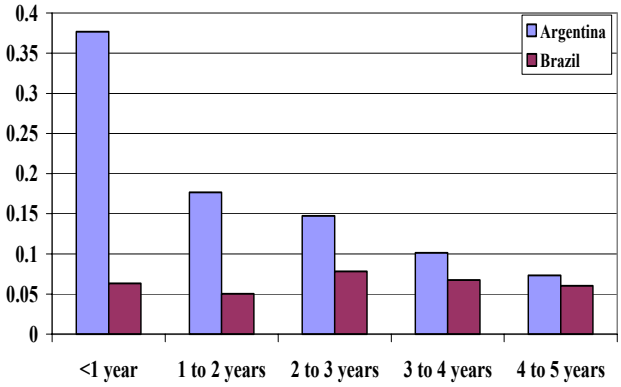


Figure 9
Default probabilities by time interval



IV. CREDIT EVENTS: CREDIT DERIVATIVES IN STRESS SITUATIONS.

A I.S.D.A Legal Definitions and Legal Risks.

- **Current Market Standard Definitions used for Sovereign Credit**

Figure 10 present the standard terms of a sovereign default swap.

A default swap is triggered when a **reference entity** experiences a **credit event** on a obligation that corresponds to the category and characteristics of **Obligations** in the term sheet. In case of **cash settlement,** the protection seller pays to the protection buyer the difference between the par and the recovery value of the **reference obligation.** In case of **physical settlement,** the protection buyer delivered **deliverable obligations** to the protection seller in exchange of their par value.

The **grace period** has been introduced in the 1999 ISDA definition to avoid a default related pure technical short delays in interest or principal payment as in the case of the City of Moscow bonds in 1998.

Generally, the set of **deliverable obligations** is larger than the set of **obligations** to prevent failure to deliver. However, certain provisions are made to limit the set of deliverable obligation: a **maximum maturity** may be set; the "**not contingent"** characteristic –i.e. the absence of issuer option or other contingencies- is used to exclude structured notes or zero coupon bonds. After a credit event, the protection seller has the option to deliver the cheapest deliverable obligation to maximize his pay-off.

Figure 10: Indicative default swap term sheet

Term	*Definition / Example*
Reference Entity	The issuer of Obligations
Reference Obligation[3]	e.g: Brazil C Bond
Credit Events	Failure to pay Obligation Acceleration Obligation Default Repudiation/ Moratorium Restructuring
Obligations	Category: "Bond" or "Bond or Loan" Characteristics Pari Passu Ranking No Domestic Currency No Domestic Issuance No Domestic Law Not Sovereign Lender
Deliverable Obligations[4]	Category: "Bond" or "Bond or Loan" Characteristics Pari Passu Ranking Standard Specified Currency Maximum Maturity (10 or 30 years) Not Contingent Not Bearer Not Sovereign Lender
Settlement Method	Physical or Cash
Grace Period	e.g. 14 days

[3] in the case of cash settlement

[4] in the case of physical settlement

The most complex credit event, **restructuring**, is discussed below. Restructuring is very often excluded from corporate credit derivatives but is always included as a credit event in sovereign credit derivatives.

- **Restructuring and obligation exchange: ISDA definitions**

Restructuring

Restructuring means any of the following five events including as a result of an obligation exchange:

(i) A reduction in the rate of interest payable.
(ii) A reduction in the amount of principal payable at maturity.
(iii) A postponement or deferral of dates for payment on accrual of interest or principal.
(iv) Any change in the ranking of priority of payment of any Obligation causing the subordination of such Obligation.
(v) A change in the currency or composition of any payment.

Provisions are made to exclude from those credit events, events, where such event does not directly or indirectly result from deterioration in the creditworthiness or financial condition of the Reference Entity. Thus, there is a net legal risk regarding in the case the bond restructuring is not an obvious consequence of a financial distress.

Obligation Exchange

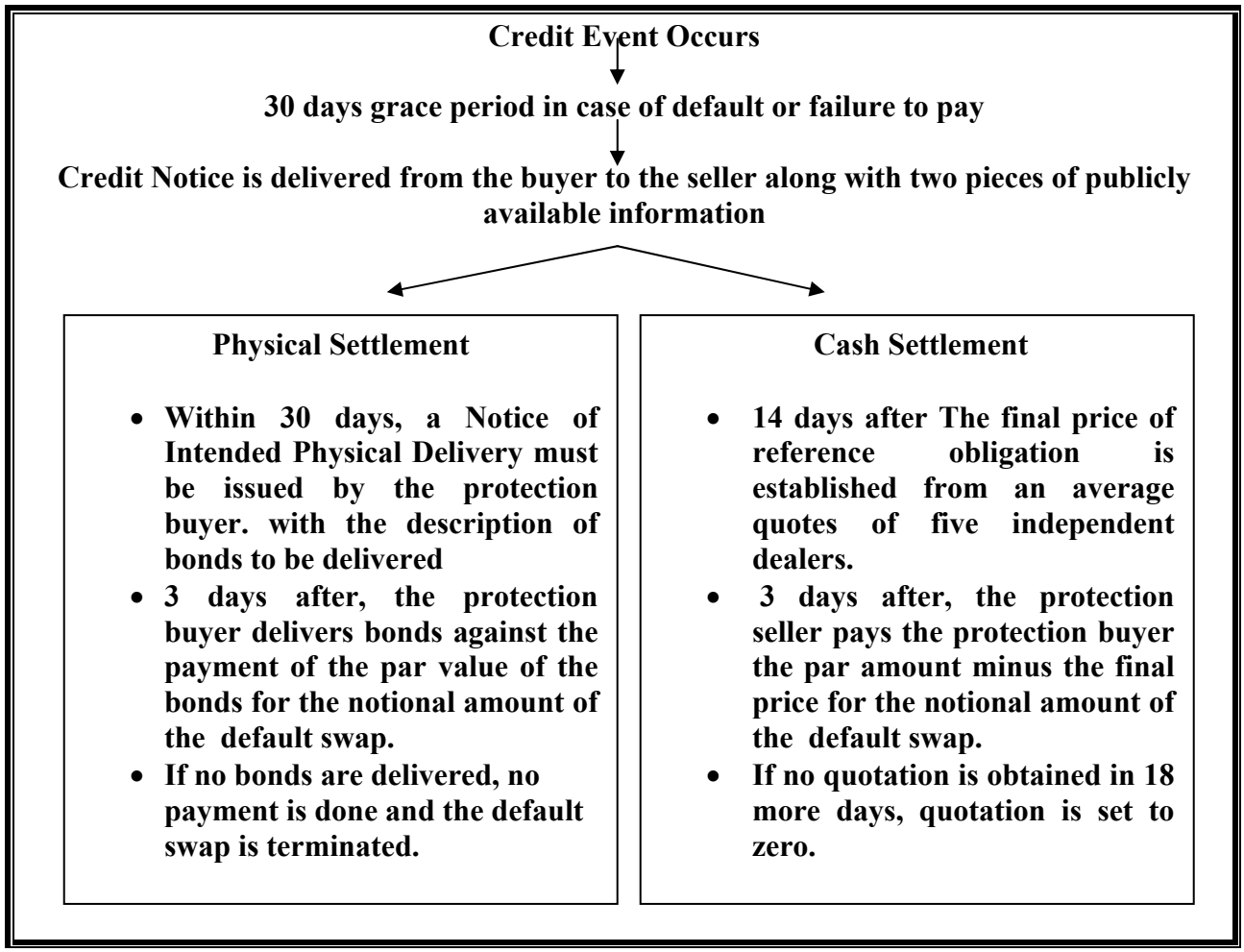
For an obligation exchange to be a credit event, two key elements matters:

(i) The obligation exchange has to be a **mandatory transfer**. An obligation exchange is not mandatory if you can hold the bond and keep the same cash flows.
(ii) In case of a mandatory transfer, **the terms of the new obligation have to be worse off** after the transfer.

Therefore, there is also a legal risk on both points. In case of a dispute on the second point a claimant challenging the materiality of a credit event will use an upward movement in the price as an argument in front of court.

- **The Credit Event Timeline**

The schema presented below describes the timeline following a credit event for physical or cash settlement:



In emerging markets, the physical settlement tends to be the dominant procedure. After a credit event, the distressed bond market is highly illiquid, and then accurate quotes are difficult to obtain. The recovery value of the bonds just after the credit event may be underestimated, especially in a middle of a financial crisis. Therefore, protection seller may expect to partially recover their loss by holding the bonds. A last reason is that protection buyers generally have deliverable obligations in their books, and have consequently a strong incentive to prefer the physical delivery.

B. Economic and Market Risks

- **Recovery uncertainty and the cheapest-to-deliver option.**

The development of credit derivatives in the corporate sector has been supported by the existence of a market for corporate distressed bonds as well as the availability of large reliable historical statistics for default probabilities and recovery rates. This is clearly not the case for sovereign obligations. For example, **there is a large uncertainty about the recovery rate on sovereign bonds**. While rating agencies are estimating recovery rates of 25-30%, a recent JPMorgan study estimates a higher recovery rate around 50% in case of default in Argentina.

In the case of credit derivatives, the uncertainty on the recovery value of bonds is exacerbating by the presence of the **cheapest-to-deliver option.** The maximal loss of a protection seller is the 100-recover value the cheapest bond in the set of deliverable bonds. In theory, in case of a default, all the prices of *pari passu* instruments must converge to the same recovery value. This is not always the case in emerging markets: distressed bonds can trade at different recovery prices reflecting different levels of liquidity. It is also possible that some bonds become *de facto* subordinated to some others bonds, even if they share *de juris* the same seniority. This uncertainty on the recovery value becomes even more severe in case of restructuring where prices do not ordinarily converge. To take into account the cheapest-to-deliver option, credit derivatives are priced according to an estimated recovery value 10-20% higher than the recovery value of bonds. However, in the case of Ecuador mandatory exchange (1999), the cheapest-to-deliver option has not been really monetized, because the cheapest bonds were very illiquid, and then only the most liquid bonds, that traded higher, were delivered.

In the corporate sector, some shortfalls of the ISDA restructuring definitions in relation to the cheapest-to-deliver option appeared clearly during the CONSECO debt restructuring in October 2000[5]. Many protection buyers gave notice of a credit event and delivered CONSECO long term bonds that were trading at considerably lower levels than the restructured banking debt. The lenders economic losses from extending the maturity of their loans to CONSECO were considerably lower than the gain from buying lower-priced bonds in the market and receiving their par value through the Credit Default Swap.

To cope with this problem, ISDA published in 2001 a **Restructuring Supplement** that includes a **Restructuring Maturity Limitation.** This provision limits the universe of deliverable obligations in case of restructuring. The maximum remaining maturity is the earlier of 30 months from the restructuring and the latest maturity of restructured obligations, provided that the deliverable obligations may in all cases have a maturity as long as the scheduled termination dates of the credit swap. For instance, suppose the default swap terminates in 18 months, the maturity limitation for deliverable obligations will be two years if the bonds have a 2 years maturity and 30 months if they have a 3 years maturity. But if the default swap terminates in 5 years, the maximum maturity of deliverable obligations will be 5 years in both cases.

[5]CONSECO, a U.S. insurance company, restructured its bank debt in October 2000.

- **Counterparty Credit Risk**

The counterparty risk is the joint realization of two events: a credit event and the impossibility to obtain from the protection seller the payment of the contingent default. This risk is highest if the protection seller is already vulnerable to a credit event: for example, if a protection on Argentina has been sold by a Brazilian Bank already exposed to the default of Argentine entities. The counterparty credit risk is made more severe than in a plain vanilla interest swap by the size of the contingent payment – a major fraction of the notional.

If the protection is sold via a credit linked note, the contingent payment is prepaid, and the counterparty credit risk is shifted from the protection seller to the protection buyer, but in this case, one of the main appealing features of the default swap, its unfunded structure, disappears.

In term of pricing, because the counterparty risk is the joint realization of two events, it could be covered by a relatively small extra-premium for investment grade rated counterparties. However for highly leveraged Hedge Funds, this counterparty risk may constitute an entry-barrier[6].

- **Hedging Risks**

Hedging a default risk is significantly different than hedging an interest rate risk. Because, interest rates movements can be modeled as standard continuous differentiable Wiener stochastic processes, dynamic optimal hedging strategies for interest swaps and options can be designed. By contrast, the evolution of default risk is more accurately modeled by a discontinuous jump process like a Poisson process that makes almost impossible an optimal dynamic hedging strategy.

The set of instruments available to hedge credit derivatives intensify the hedging risks. Due to the lack of liquidity on the credit derivative market, and the absence of a secondary market, it is very difficult to hedge default swap using other credit derivatives. Then, broker-dealers, who are structurally sellers of protections are hedging their book by taking short positions on bonds via the repo market. Because there is no repo open in emerging market for more than one month, dealers are facing a "roll" risk when they have to roll over their short positions via a new repo. When credit risk is rising, there is an increase in the demand to borrow bonds to hedge credit exposure increases. Therefore, the repo market clear at a "special" repo rates far below Libor. This phenomenon is known as the "short squeeze". The repo market can become so illiquid that rolling short positions become impossible. Therefore, broker-dealers end up with outright highly risky positions in credit derivatives.

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[6] The problem is quite similar with the **selling** of options by Hedge Funds.

- **Credit Derivatives and the Creditor Moral Hazard problem.**

Large creditors may have an influence on triggering a credit event, especially in loan markets. Let us suppose that some banks have made large loans to a sovereign and, at the same time, have bought default protection. When the sovereign, in financial distress, is cash constrained, these banks can, by their action, either force the sovereign to default or offer him new loans to avoid a credit event. In this situation, banks that have bought protection are clearly on both sides of the trade. They are **self-dealing,** and this generates a moral hazard problem.

To mitigate this problem, the Restructuring Supplement of ISDA introduced a new provision: the Supplement ignores restructuring under any facility held by less than four unaffiliated creditors or which could have been approved by less than a two-third majority of creditors. With this provision, it will be much more difficult for a single creditor to generate a partial restructurating in order to realize the potential value of default swaps.

- **Credit derivatives, market completion and credit risk-sharing**

The contribution of credit derivatives to a more efficient risk sharing in emerging market is a debating issue. In an ideal bond market, where you can sell or short bonds with no liquidity or collateral constraints, default swaps are simply useless instruments. But, as we mentioned before, short positions in emerging markets are constrained by the liquidity conditions on the repo market. Using credit derivatives, it is possible to lock a short exposure to a credit for a much longer maturity than via repo. However, long default swaps positions are hedged by short positions in bonds and the price of credit derivatives is adjusted to take into account the hedging risks on the repo market. Then **credit derivatives are not *stricto sensu* completing markets.**

Nevertheless, **credit derivatives can be seen as improving the credit risk sharing between different types of investors**. Let for example assume two classes of investors: a first class of investors, such as mutual funds, who want to maintain a long term exposure in emerging market, but want to be able to limit their credit risk exposure, a second class of investors, such as major bond dealers, who managed large credit risks trading books. The first class is willing to buy credit protection from the second class, even if it seems expensive, because they do not have the expertise with managing default risk in stress situation. The second class is willing to offer this protection, because they know how to actively manage and hedge a vast diversified credit risk portfolio.

C. Debt Restructuring in a large emerging market borrower and credit derivatives

In this section, we explore the consequences of the decision of a large emerging market borrower to undertake a debt restructuring under financial stress.

- **Credit derivatives exposure and potential losses**

Based on Deutsche Bank[7] estimates, the overall size of emerging market credit derivatives is $200 bn in notional amount of contracts. Let assume that the country X has a market share of 5%, $10bn, mostly in default swaps and credit linked notes with physical settlement. Then, in case of credit event, the maximal net loss of protection sellers is: Notional Value – Recovery Value of the cheapest to deliver bonds.

The credit derivatives risk are likely to be concentrated in trading books of major investment banks with broker-dealer credit derivatives activity. The credit derivatives risks are generally hedged via short positions in bonds through the Repo market. Those banks are now facing difficulties to rollover their hedge because of the lack of liquidity in the REPO markets. Then, they are forced to keep a risky outright unhedged sell position in credit derivatives. If we assume that 50% of credit derivatives risks are unhedged and a recovery value of 40%, the total loss can be estimated at $3 bn after a credit event.

- **Restructuring scenari**

1) Default followed by a debt restructuring.

The main advantage of default is that it constitutes unambiguously a credit event. The timeline to the final settlement is longer because it includes a grade period. The monetization of the cheapest-to-deliver option will depend on the timing of the announcement of the conditions of the debt restructuring. If this announcement is delayed, the period between the default and the restructuring, speculations on cheapest-to-deliver bonds may arise.

2) Pure debt restructuring.

In this case, it is the debt restructuring that can constitute the credit event. If the debt restructuring is voluntary, there is no credit event and default swaps are not triggered. If unprotected debt holders have a strong preference for a voluntary exchange that is always associated to better terms of exchange, debt holders with credit protection would rather prefer a mandatory exchange that will trigger their protection. In the improbable extreme case, where protected debt holders have a significant part of the debt to be restructured, such holders could try to provoke the failure of a volunteer exchange forcing the country to a mandatory exchange.

In case of a mandatory exchange, there is a credit event and default swaps are triggered. If the restructuring covers most of the deliverable bonds. The cheapest-to-deliver option will have a small value. The outcome would be different if the restructuring is only partial and if some deliverable bonds are now perceived as junior relatively to the new issued bonds.

[7] Deutsche Bank is the larger broker-dealer of Emerging Default Swaps with a claimed market share of 50%.

D. Application: Credit Derivatives in the Argentina Debt Crisis

- **A unanimous consensus on the credit event**

On December 23, 2001, a moratorium on all external debt effective immediately has been publicly announced by the interim president of Argentina Adolfo Rodriguez Saa. The unanimous consensus in the dealer community was to consider that the moratorium constitutes a credit event consistent with the repudiation/moratorium credit event in the ISDA definition (see section IV.A). Consequently all the credit derivatives that include this credit event – which is perfectly standard in emerging markets sovereign default contracts – have been triggered.

Some legal disputes arise regarding the set of deliverable bonds. The possibility to deliver Argentina Bonds maturing in April 2008 and April 2018 was first challenged on the basis that those bonds have no coupon due in the next three years. However, they were subsequently accepted as deliverable bonds.

- **A smooth settlement process**

For a standard default swap with physical delivery the maximum period of settlement period is 33 days after the 30 days of grace period. According to Deusche Bank, 95% of the default swaps have been settled by mid-February and no failure to deliver has been reported.

As the dispersion of deliverable bonds prices has been low, the option to deliver the cheapest bond has not been really monetized. A minor exception concern the delivery of some bonds denominated in Yen that were trading at a discount. At the time default swaps have been settled, the average recovery value of bonds was a slightly below 30 in the range of rating agencies recovery estimates (25-30%). According to dealers, the delivery of bonds did not have any significant impact on bond prices.

- **Exposures and losses**

The total amount of Argentina credit protection in the market was estimated around USD 10 BN notional outstanding covering hundred of trades. This corresponds to a contingent payment of US 7 BN from the protection buyers to the protection sellers. No default from protection seller has been observed.
The main-broker dealers, who are structurally sellers of credit protection, have been apparently able to hedge their books by shorting the bonds on the repo market until the end of 2001. The main losses have been incurred by end-users. Some European commercial banks, especially in Italy, seem to have suffered from specific significant losses in the credit derivatives markets.

- **Argentina: a successful test for the credit derivatives market**

The Argentina default – the largest emerging market bond default - provided the key opportunity to evaluate the performance of the credit derivatives market. The smoothness of the

settlement process and the absence of legal disputes have shown the relative maturity of the credit derivatives market. Moreover, dealers have been able to efficiently manage hedging risks and the counterpart credit risks did not materialize.

In the first semester of 2002, the credit derivatives market has been particularly resilient: activity stays high in countries like Brazil, Columbia, Mexico and Russia and smaller emerging markets economies have traded like Chile, Uruguay and Croatia.

V. CONCLUSIONS

Despite its rapid growth in the last five years, the credit derivatives emerging market is not yet a fully mature market. In emerging countries, there is a large degree of complementarities and interdependence between the bond market, the repo market and the credit derivatives market. One can then expect that the core participants to credit derivatives markets will remain a subset of the participants in the bond market. The recent validation of internal risk models of many banks will boost the use of credit derivatives for prudential risk management.

Even if default swaps are now very standard products with a robust and simple legal documentation, some legal uncertainties remain especially in the scenario of a debt restructuring. Default swaps have though already demonstrated efficiency in a credit event situation (Russia 1998, Ecuador, 1999, Argentina 2001), and the purchase of credit protection is appealing for investors who want to control and optimize their credit exposure on a medium term basis. However, default swaps premiums will probably stay relatively expensive to cover hedging risks incurring by protection seller.

In an emerging economy under financial stress, the share and the nature of investors protected or exposed via credit derivatives will have to be taken into consideration in the perspective of a debt default or restructuring.

Annex: Default probability term structure methodology

Definitions

$DS_{t,t'}$:Default Spread between t and t'
$R_{t,t'}$: Risk Free Rate between t and t'.
Ps_t : Default Probability between t and t+6 months conditional on no default before t
P_t: Default Probability between t and t+1 conditional one no default before t
S_t : Survival Probability of an obligation at time t
D_t : Cumulative Default Probability of an obligation at time t
H_t : Probability of a default between t and t+1
R: the recovery rate.

Step 1: Computing a forward default spread curve.

With indicative levels for annualized default spread with a maturity of 1, 2, 3, 4, 5 years, the ***no arbitrage condition*** may be applied iteratively to extract one year forward default spreads starting in year 1, 2, 3 and 4 :

$$(1+ R_{1,2} + DS_{1,2}) = (1+ R_{0.2} + DS_{0,2})^2 / (1+ R_{0.1} + DSA_{0,1}) \qquad (1)$$

Step 2: Computing the term structure of conditional default probabilities

Having extracted in Step1 the forward default term structure, we can simply treat each interval of one year independently. The forward spread then reflects the conditional risk of default for the given period. Recalling that the default premium paid every 6 months covers the expected cost of default for the given 6-month period, we apply the ***risk neutral valuation principle*** to obtain the conditional 6-month default probability Ps_t :

$$(1+ R_{t,t}/2) = (1- Ps_t)*(1+ (R_{t,t} + DS_{t,t'})/2) + Ps_t * R \qquad (2)$$

Knowing that no default over one year is equivalent to no default in any of the two 6-month period, we obtained the annualized probability of default as $P_t = 1-(1- Ps_t)^2$.

Step 3: Survival probability, Cumulative default probability and default probabilities by time period

Having derived for each yearly period the condition default probability, we can then simply compute:

-The Survival Probability: $S_t = (1- P_0)(1- P_1)...(1-P_t)$
-The Cumulative Default Probability: $D_t = 1- S_t$
-The Probability of a default between t and t+1: $H_t = (1- P_0)(1- P_1)….(1-P_{t-1})*P_t$