Hong Kong Monetary Authority

December 2003

CREDIT RISK TRANSFERS USING DERIVATIVES AND IMPLICATIONS FOR FINANCIAL MARKET FUNCTIONING

KEY POINTS:

- *The global credit derivatives market has experienced rapid growth in recent years. The notional amount of transactions increased six-fold during 1997-2001. Underpinning these developments are the differences in the risk appetite of market participants in various sectors. Improvements in infrastructure, documentation, legislation and reporting requirements for credit risk transfer transactions will encourage further growth of the market.*

- *The development of the credit risk transfer market has many benefits. It enables the transfer of risk to those most willing and able to assume it. A liquid market in credit risks with diverse participants and a market-based price discovery process could potentially improve the stability of financial markets by enhancing the transparency and efficiency of risk pricing.*

- *The empirical study finds that the credit default swap (CDS) premium, which is the cost of purchasing credit protection, provides useful information for pricing credit risk. The premium supplements stock and bond prices as an additional indicator to help predict corporate or sovereign defaults.*

- *The highly-leveraged nature and complexity of credit derivatives led to concerns about their implications for financial stability. Credit risk transfer can increase inter-linkages among financial institutions, heightening the possibility of spillover effects in case of a major credit event. It also complicates assessment of credit risk distribution among financial institutions.*

Prepared by : Ada Lee and Eve Law
Research Department
Hong Kong Monetary Authority

I. INTRODUCTION

The use of derivatives in the credit risk transfer market has been growing rapidly and has attracted attention of central banks and international financial institutions. The notional amount of transactions increased six-fold to US$1.2 trn in 2001 from US$0.2 trn in 1997 (BBA, 1997/1998 and 2001/2002). The complex nature and risk characteristics of the instruments have aroused regulators' concern about their potential impact on the financial system.

The growth of the credit derivatives market has many benefits. It enables the dispersion of risk to those most willing and able to assume it. Buyers of protection can manage their credit risk exposures, while sellers can benefit from yield enhancement. Efficiency gain arises from the better allocation of risks as well as a more transparent and efficient price discovery process.

Alongside the gains of the credit risk transfer market comes the potential challenges to financial market stability. Credit default swaps (CDSs), for example, are highly leveraged and may lead to speculative excesses. In addition, credit risk transfer increases the inter-linkages between financial markets and institutions, heightening the possibility of spillover effects in case of a major credit event. It also complicates the assessment of credit risk distribution among financial institutions. The market provides instruments for regulatory arbitrage, thereby raising supervisory concerns.

The market for credit risk transfer using derivatives is at a relatively early stage of development and is still evolving. Given the complex and innovative features in the credit risk transfer instruments, enforcement and contract specification problems are common. Further market development would depend on the parallel upgrading of the existing legal framework and documentation.

This paper examines the development of the credit derivatives market and its effect on financial market functioning and stability. Section II covers the main instruments, market participants, current status of the market, and factors contributing to the rapid growth. Section III discusses the implications of credit derivatives on financial market efficiency and stability. An empirical study is conducted on the usefulness of the CDS spread in facilitating the price discovery process of credit risk by using Hong Kong corporate and Asian sovereign data. Section IV concludes.

II. THE DEVELOPMENT OF THE CREDIT RISK TRANSFER MARKET

Credit risk arises out of the possibility that a party may fail to perform fully on its financial obligations. It includes the risk of a borrower or bond issuer failing to repay the principal or interest in a timely manner, and the risk that a guarantor or derivative counterparty is unable or unwilling to meet its obligations.

1. Major Instruments

The emergence of credit derivatives products facilitates the transfer of credit risk without trading the underlying assets that give rise to such exposures. Unlike securitisation, which involves the sale of assets to a special purpose vehicle (SPV) which finances the purchase through issuance of asset-backed securities to investors, credit derivatives deals can be initiated by parties who may or may not own the underlying assets. Credit derivatives transactions encompass a range of instruments that allow either full (e.g. total return swaps) or partial credit protection under specified circumstances (e.g. CDS) for the protection buyer. The characteristics of some common credit derivative instruments are summarised below:

i. Credit default swaps (CDSs)

A party taking a long position in an underlying asset may hedge its credit risk (protection buyer) by entering into a CDS with a counterparty (protection seller) (**Chart 1**). Under the bilateral contract, the protection buyer makes a periodic payment of premium to the protection seller, who is obliged to make a contingent compensation to the buyer when a specified market event occurs. A CDS is unfunded, that is, the protection seller does not have to provide upfront funding. As such, while the protection buyer is covering the credit risk of the underlying assets, he is exposed to counterparty risk from the bankruptcy of the protection seller.

ii. Credit linked notes (CLNs)

A CLN is a regular coupon-bearing note, the payment of which is linked to credit events on a reference asset. An investor (a protection seller) of the CLN makes an upfront payment for the instrument, and in return receives periodic coupon payments. CLNs normally offer a higher yield than ordinary notes. If a credit event occurs, the investor is delivered the reference security which has defaulted (physical settlement) or paid a net settlement amount equal to the market price of that asset (**Chart 2**). Given the prefunded nature of CLNs, the protection buyer is not subject to counterparty risk although the seller is exposed to such risk.

Chart 1: A Typical Credit Default Swap (CDS)

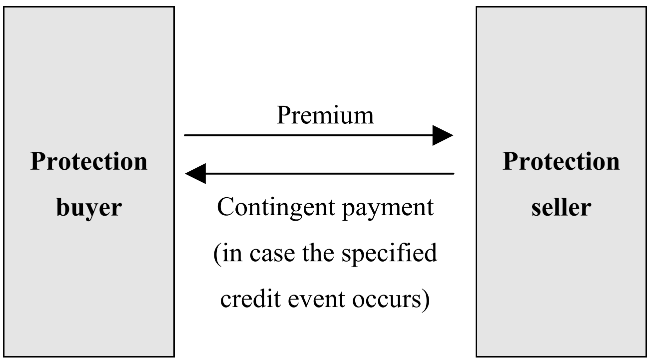
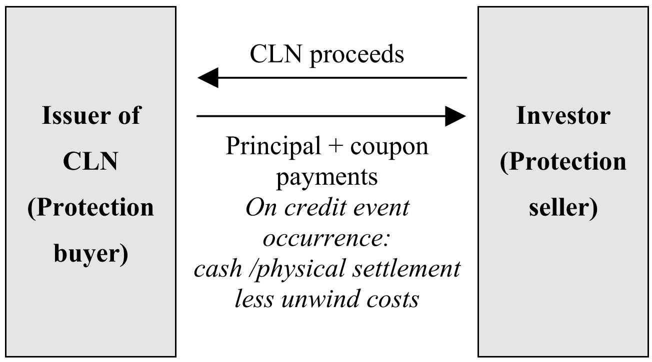


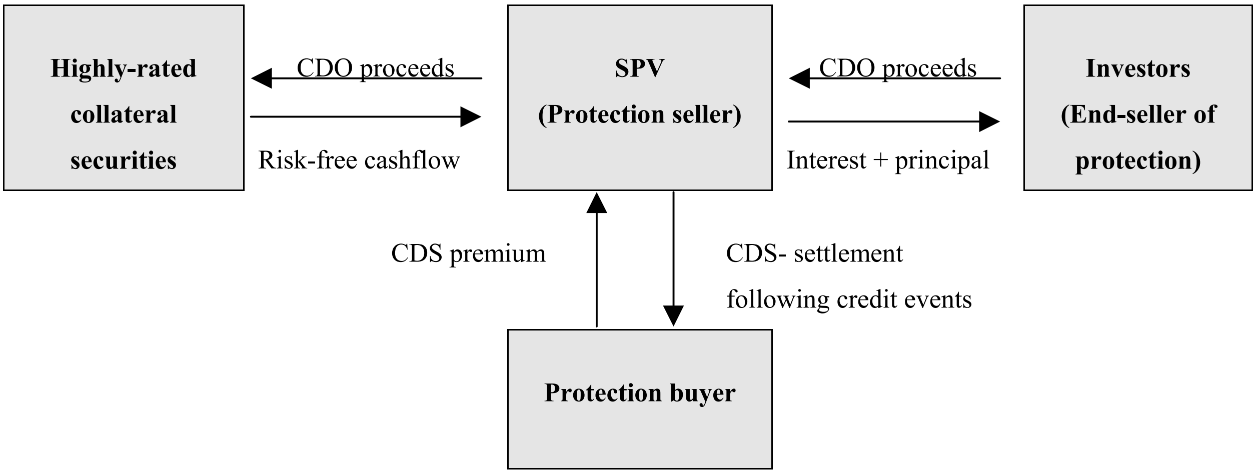
Chart 2: A Typical Credit Linked Note (CLN)



iii. Synthetic Collateralised Debt Obligations (CDOs)

Synthetic CDOs reduced counterparty credit risk for both protection buyers and sellers who have potential claims on the SPV that are at least partly backed by the collateral securities. In a typical synthetic structure, the SPV issues CDOs to the end-sellers of protection and invests the proceeds in high-quality bonds and asset-backed securities. The investors receive the return on the collateral and the premium on the CDS the SPV sells to the protection buyer. In case the credit event occurs, the payment to the protection buyer will take priority over that to the investor, thereby reducing the principals and/or the interest payments to the investors (**Chart 3**).

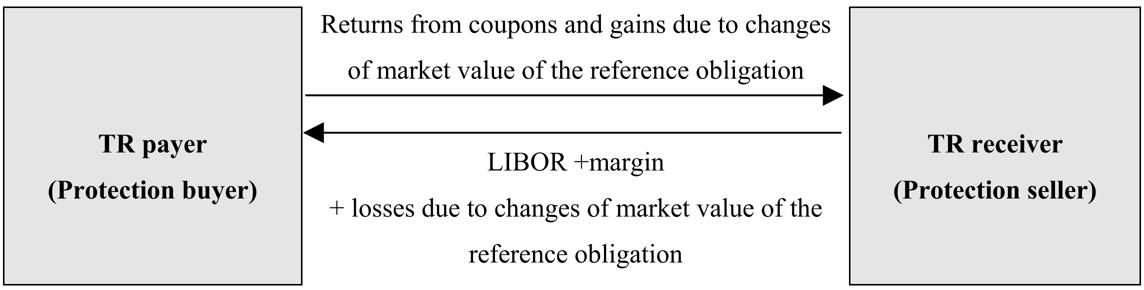
Chart 3: Synthetic collateralised debt obligations (CDOs)



iv. Total Return Swap (TRS)

Under a TRS, one party ("the TR payer") pays to its counterparty (the "TR receiver") the total return of a reference asset.[1] The TR payer in return usually gets a stream of LIBOR-based cashflows (**Chart 4**). A TRS is distinct from a CDS in that payments between the parties of a TRS are based upon changes in the market valuation of a specific credit instrument, irrespective of whether a credit event has occurred.[2]

Chart 4: Total Return Swap (TRS)



2. Market Participants

Major participants of the credit derivatives market include end-buyers of protection, typically trying to hedge credit risk taken in their business; end-sellers

[1] A TRS can be used where the non-domestic holder of a fixed income security is subject to a withholding tax, but that tax may be avoided if the debt instrument is held by a domestic investor who pays the total return to a foreign investor by way of a TRS.

[2] In addition to credit risk, the protection seller also bears the risk arising from changes in market value.

of protection, seeking to diversify their portfolios to achieve higher yields; and intermediaries, which help maintain a liquid and efficient market by buying and restructuring products from originators and transferring the instruments to investors.

i. Commercial banks

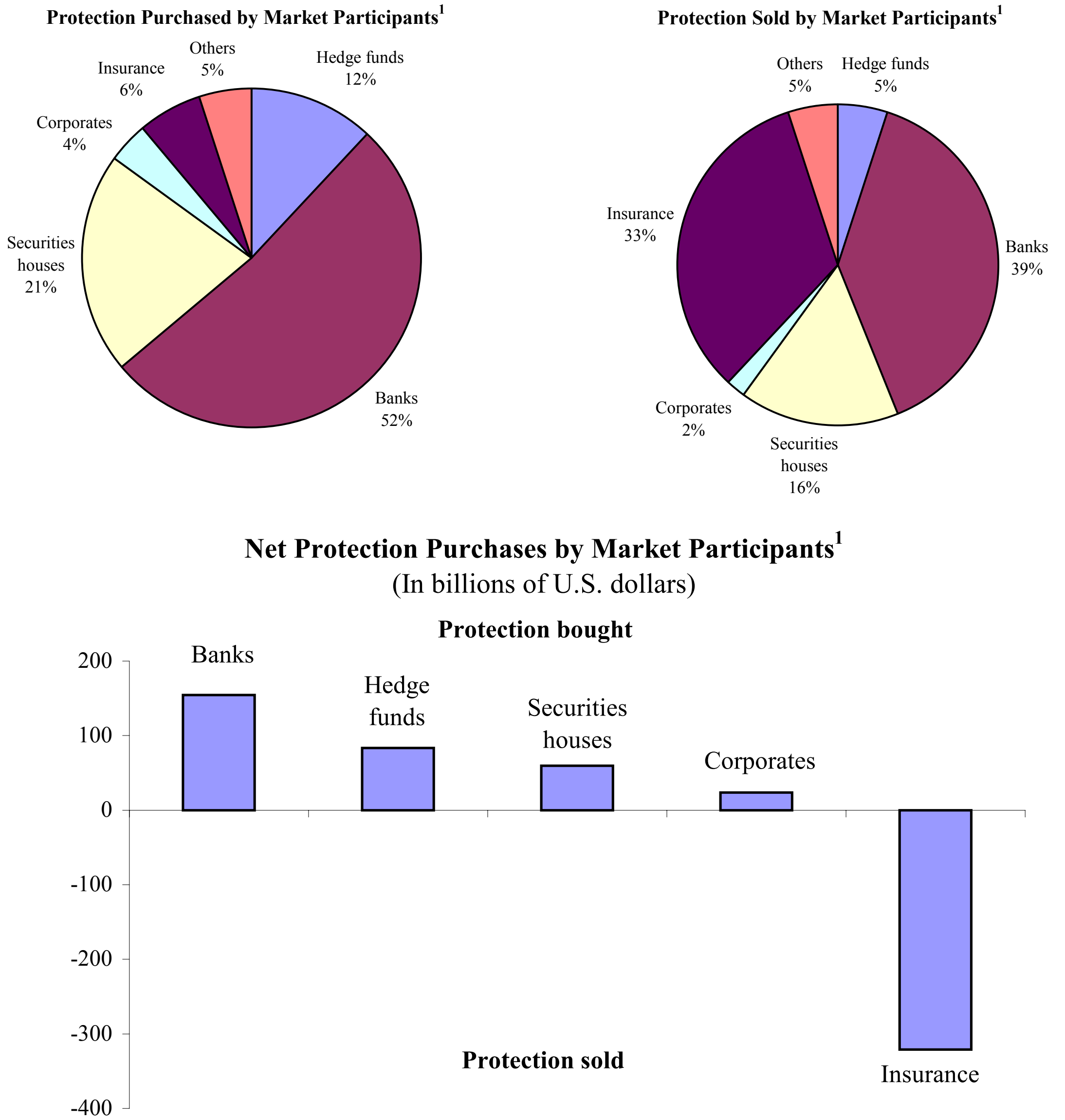
Banks, in particular, a few major global banks, are the dominant buyers and sellers of credit derivatives in the global market (**Chart 5**). Although active on both purchase and sales of credit derivatives, commercial banks are primarily net buyers of protection.

Some banks use credit derivatives to manage regulatory capital. Under the Basle Accord, banks have to hold 8% regulatory capital for risk-weighted assets. Based on banks' own assessment of risk, the capital needed to back up less risky loans may be lower than the required amount. They thus have an incentive to transfer credit risk exposures arising from those loans to other parties by buying protection through credit derivatives. For example, consider a loan to a corporate in a non-Organisation for Economic Co-Operation and Development (OECD) country carrying 100% risk weighting under the Basle Capital Accord.[3] If it is hedged with credit protection bought from an OECD bank, the risk weighting would be reduced to 20%, and the corresponding capital charge would decrease from 8% to 1.6% (JP Morgan, 1999).

Banks also sell credit risk protection to enhance return and diversify their portfolios. In some cases, they sell protection on high-quality credits to subsidise the purchase of credit protection on other credits.

[3] Under the Basle Accord, the capital ratio of banks (i.e., the ratio of capital to risk-weighted assets) should be maintained at a minimum level of 8%. Interbank loans to banks incorporated in OECD-member countries generally receive a 20% risk weight (1.6% capital charge), while those from other countries receive a 100% risk weight (8% capital charge) (BIS, 2001). The risk weighting of the underlying assets for credit derivatives can, in some cases, be replaced by that of the protection seller (JP Morgan, 1999).

Chart 5: Major Participants in Global Credit Derivatives Market in 2001



Sources: British Bankers' Association, Credit Derivatives Survey 2001/2002; and Bank of England (2001).
Note:
[1] *Insurance includes insurance companies and mono-line/re-insurers.*

ii. Insurance companies

Insurance companies are the major net sellers of protection in the credit derivatives market. They diversify their portfolios to achieve higher yields by taking on credit exposure. In some cases, insurance companies sell protection through CDSs instead of buying bonds for investment to gain benefit from the better liquidity in the credit derivatives market.

iii. Investment banks, hedge funds and securities houses

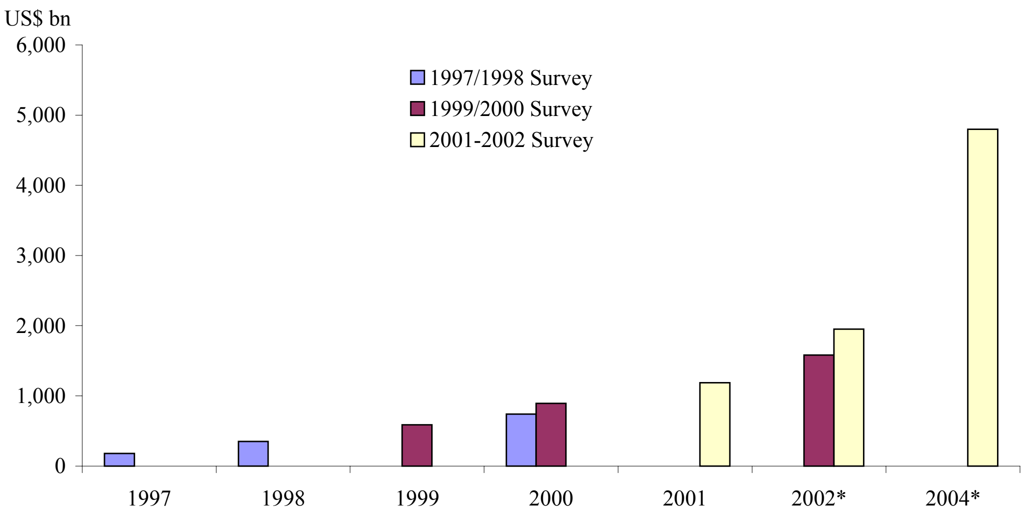
Investment banks, hedge funds and securities houses are key buyers of credit protection. Some of them use empirical models to assess credit risk before deciding whether to transfer credit risks through the derivatives market (**Box 1**). Through trading credit derivatives, they can manage the credit limits in their derivatives and bond portfolios, in particular, for riskier instruments such as illiquid corporate and emerging market bonds. They can reduce undesirable sector or geographical concentrations in their portfolios through the purchase of credit protection, rather than by selling the underlying securities.

Investment banks and securities houses are also major intermediaries for credit derivative transactions. They bring together market participants with diverse needs. They also pool together single credits to create portfolios demanded by investors. In return, they earn commissions on credit derivatives transactions.

3. Current Status of the Market

The credit derivatives market has grown significantly since the mid-1990s, with the expansion in the past few years being particularly rapid. According to the British Bankers' Association, the notional amount of global credit derivatives market increased by six-fold to an estimated US$1.2 trn between 1997-2001 and was expected to have grown to US$2.0 trn in 2002 and reach US$4.8 trn by 2004 (**Chart 6**).

Chart 6: Global Credit Derivatives Market Excluding Asset Swaps



Source: British Bankers' Association
** Projected figures*

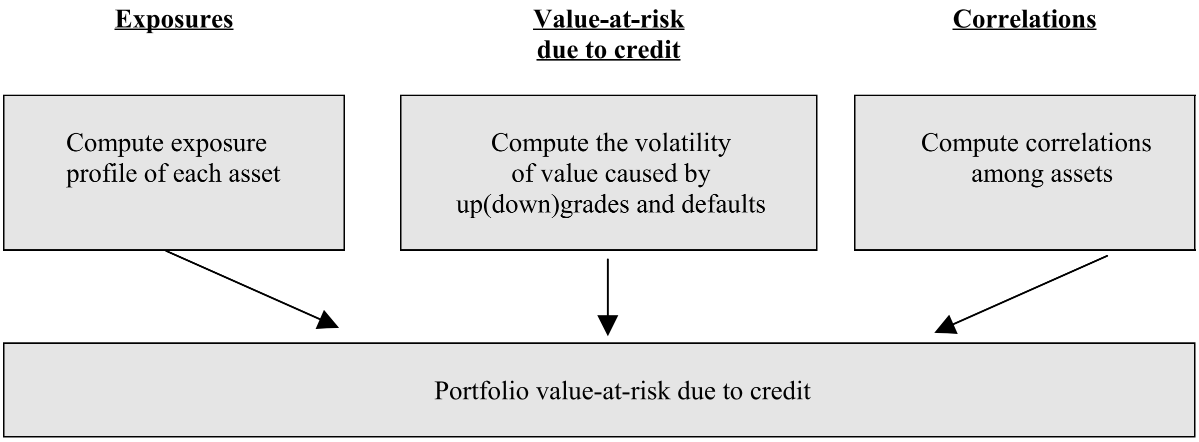
Box 1: Credit Portfolio Models

With the rapidly growing market in credit derivatives, the possibility of active credit portfolio management has been enhanced. To benefit from those opportunities, many financial institutions have used empirical models, e.g. KMV (discussed separately in **Section III** and **Annex 1**) to evaluate credit risk for their portfolios. Some other commonly applied frameworks are summarised below:

CreditMetrics by J.P. Morgan

CreditMetrics calculates probable portfolio losses due to credit events within a fixed time horizon (JP Morgan, 1997). It first defines the possible states of individual obligors (borrowers, counterparties or issuers) in the portfolio, that is, ratings upgrade, downgrade and defaults. Then, it describes the probability that the obligors are to be in any of those situations during a specified horizon. The associated asset value in each probable credit condition is subsequently estimated. Finally, correlated credit movements of obligors (such as several downgrades occurring together) are addressed. The standard deviations of asset value changes, and the value-at-risk (VAR), that is, the maximum amount of loss at a given level of significance are projected. The credit risks to each obligor are aggregated to arrive at a portfolio value for each particular scenario (**Chart A**). The model allows banks to calculate the present value of a portfolio based on credit risk. However, market risk is not incorporated explicitly.

Chart A: CreditMetrics Methodology

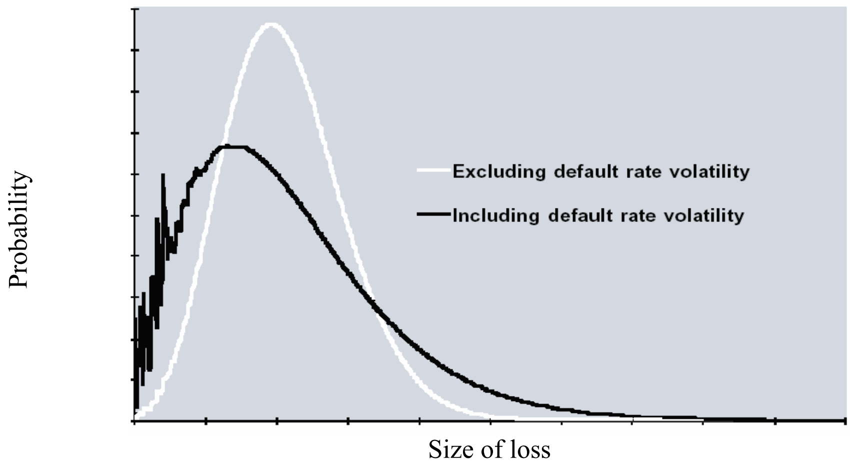


Source: JP Morgan

CreditRisk+ by Credit Suisse First Boston (CSFB)

While CreditMetrics considers default rates as discrete values, the CreditRisk+ model considers default probability as continuous random variables (CSFB, 1997). Systemic factors, such as the state of the economy, cause incidences of default to be correlated, although there may not be a causal relationship among them. The factors are reflected in the volatility of default rates for each obligor over time, which is incorporated in the model. A loss distribution for a portfolio of credit exposures is generated based on the default rates and volatility (**Chart B**). The risk contribution by each obligor can then be estimated.

Chart B: Sample Distribution of Default Loss of CreditRisk+ Model



Source: *CSFB*
Note: *The chance for extreme losses increases when default rate volatility is considered.*

CreditPortfolioView by McKinsey

The approach first assigns a rating and a country-industry-segment to every credit exposure/debtor in the portfolio (Kern et al., 2001). Then macroeconomic variables representing systematic risk of the default rates in the chosen country-industry-segments are selected. The most suitable exogenous factors to explain past fluctuations of the default rate in this segment are identified based on regression results. The historical auto-regressive patterns are used to simulate the realisation of each macro variable for the next period, which are then translated into "current" default probabilities based on the regression relationship.[4] Monte-Carlo-simulations are used to generate the portfolio loss distribution.

Credit portfolio models can be used to identify the costs of over-concentration and benefits of diversification of credit risks. Marginal risks, that is, the amount of portfolio risk that can be reduced if an exposure is disposed of, can be projected, helping portfolio managers to decide on whether to sell or purchase that exposure. The models can also be applied to estimate the level of capital required to support a credit portfolio. Credit limits can be set accordingly to control risk based on contributions of risks by various assets.

---

[4] An auto-regressive process is a time series where the latest observation depends principally on previous observations in the series. A purely auto-regressive time series model has the following structure: $Y_t = \alpha_1 Y_{t-1} + \alpha_2 Y_{t-2} + ... + \alpha_p Y_{t-p} + u_t$ where Y_t is the t^{th} observation on the dependent variable after subtracting its mean, and u_t is an error term with zero mean and constant variance that is uncorrelated with u_s for $t \neq s$.

However, the size of the market is still small compared to the entire OTC derivatives market, which amounted to about US$100 trn in 2001. The credit risk transfers vehicle is anticipated to account for an increasing share of the OTC derivatives market in the coming years.

Single-named CDS was the most popular credit derivatives product, capturing almost half of the estimated global market share in 2001. Portfolio products and CDOs together accounted for around one-fifth of the outstanding transactions, and are expected to gain importance in the coming years. The instruments traded in the credit derivatives markets are mainly of medium-term tenors of one to five years. Corporate assets were the major underlying instruments for credit derivatives, accounting for more than half of the estimated transactions in 2002, while bank and sovereign assets each accounted for one-fifth of the market share. The underlying assets are mostly of A-BBB credit ratings.

While the credit derivatives market was immature in emerging Asia before the 1997/98 financial crisis, the average daily trading volume of CDS was estimated to grow to US$200 mn in 2002, from US$100-150 mn in 2001 (IMF, December 2002). Most of the turnover stemmed from investors' buying of the derivatives as an alternative means of gaining exposure to cash bonds, given the decline in issuance of short and medium-term bonds after the crisis. Corporates and local financial institutions are major buyers of credit protection. A handful of large banks are the major market makers, while medium-sized banks, insurance companies, pensions and investment funds are active investors. There are liquid sovereign CDS markets with maturity of one to ten years in China, Malaysia, Korea, Thailand and the Philippines.

Credit derivatives have a big potential of growth in Asia for a number of reasons. The CDS premium is a better reflection of credit risks than the bond spreads because of higher liquidity compared to some domestic debt markets. For example, the CDS market has been regarded as a better indication of sovereign risk in Thailand than US dollar government bonds, which are less liquid. Market participants use CDS to take short positions on bonds given the illiquid repo markets. Hedge funds also unload credit risks arising from convertible bonds through CDS. In other cases, the instrument can fill in the gap in the market-based yield curve which results from the shortage of supply of bonds of certain maturities.

The credit derivatives market is still at its early stage of development in Hong Kong. Market activity is dominated by foreign bank players (HKMA, 2003). Local banks account for a small share of credit derivatives transactions in Hong Kong, but their participation has increased, as evidenced by a doubling of gross positions from 1999 to 2002. CDS and CLN are the most common types of credit derivatives used in Hong Kong. For most of the local banks and foreign authorized institutions (AIs), the main purpose of credit derivative operations is to assume credit exposures. Major foreign banks also use credit derivatives for hedging, trading and marketing purposes. Overseas financial institutions are the most common counterparties for those transactions. Anecdotal information suggests that the credit derivatives of some Hong Kong corporations are popular among Asian investors.

The Hong Kong Monetary Authority (HKMA) issued a guideline on the supervisory approach to credit derivatives in 1999, which was superseded by a more comprehensive one in 2001, to encourage the adoption of appropriate risk management policies and procedures. Apart from setting out the capital requirements and large exposures treatment for credit derivatives, in light of the growing size of the market and product complexity, the expanded guideline includes more elaborate risk management requirements for credit derivatives operations. In particular, AIs are required to attend to the potential legal risk arising from unenforceable contracts, which may result from, for example, inadequate documentation, lack of authority for a counterparty to enter into the contract (or to transfer the asset upon occurrence of a credit event), uncertain payment procedures associated with bankruptcy proceedings or inability to determine market value when an estimate is required (HKMA, 2001).

4. Factors Driving the Rapid Market Development

The rapid expansion of the credit derivatives are driven by economic factors, such as the need for risk diversification, as well as regulatory and other structural incentives, such as accounting and tax treatments of different types of financial intermediaries and contracts. According to recent surveys by the British Bankers' Association, trading and market making as well as active portfolio management have been the main drivers for trading credit derivatives. The greater awareness of risks, as a result of recent corporate and sovereign defaults, may have prompted financial institutions to adopt a more proactive approach in trading and managing credit exposures.

Differences in the risk appetite of companies or financial institutions in various sectors have boosted the growth of the credit derivatives market. As mentioned earlier, banks use credit derivatives to transfer credit risk to each other and to other types of firms to hedge their credit exposures resulting from daily lending and borrowing activity. As sellers of credit risk protection, insurance companies and securities firms can obtain exposure to banks' portfolio.

Credit derivatives may be preferable to insurance policies for hedging risk in many cases. The former, being traded over the counter (OTC), are more liquid, flexible and transparent compared to insurance products, which are bilateral agreements between the insurers and the insured. In addition, credit derivatives are usually based on standard definitions of default, which facilitate hedging. The contingent payment is made only under the condition that the particular credit event happens ("state-dependent"). It is different from a credit insurance policy, the payment of which is not only "state-dependent" but also "outcome dependent" (if a loss is realised by the buyer) (Rule, 2001). As a result, credit derivatives are better suited to risk transfers when both parties have equal access to public information about the nature of the risk. Insurance policies are usually preferred when there is information asymmetry between the two parties about the risk. The insured are obliged to disclose relevant information to the insurer but credit derivative buyers are not required to do so. Credit derivatives are more suitable for protection buyers who want an unconditional risk transfer rather than insurance, the indemnities of which depend on the insurer's assessment of losses incurred by the insured.

The credit derivatives market has become more transparent and accessible to a wide range of investors, with improvements in infrastructure. Creditex and CreditTrade, two internet-based transactional and informational platforms were launched in 1999, providing liquidity, standardisation and transparency to the credit derivatives markets.

The ongoing development of documentation and legislation has also facilitated the growth of the market. Many debates have arisen from the Russian crises in 1998 over the precise definition of default, reference obligations and the settlement mechanics. To reduce the potential for disputes, the International Swaps & Derivatives Association (ISDA) has revised documentation guidelines on credit derivatives in 1999, with the introduction of common definitions. Some other credit events thereafter have revealed shortcomings about the terms on restructuring and grace periods, encouraging the ISDA to further modify the guidelines (BIS, 2003).

III. IMPLICATIONS FOR FINANCIAL MARKET FUNCTIONING

1. Effect on Financial Market Efficiency

In theory and if markets are efficient, the CDS premium should not contain any additional information to that reflected by credit spread. The CDS premium and bond spread for the same reference entity, both measuring the default risks, should be close to each other. When an investor buys a bond and a corresponding CDS for protection, he should have eliminated most of the risk associated with the default of that bond issuer. Arbitrage opportunities will emerge if there is a substantial difference between the two amounts.

However, the equivalence of CDS and bond spreads may not hold in practice. In some cases, the CDS premium may be lower than bond spreads because of the residual credit risk that has to be borne by the protection buyers. Unlike the purchase of a bond, which is free from counterparty credit risk, the CDS is a bilateral transaction under which the protection buyers are exposed to risk from bankruptcy of the sellers (Marsh, 2002). In addition, the CDS only pays the par value of defaultable bonds but does not cover the coupon payment, making default swap premium lower than credit spread. However, other factors may drive bond spreads lower than the CDS premium. Some investors may prefer buying debt securities rather than selling protection through CDSs as they can enjoy contractual rights specified in bond covenants. The different liquidity and demand-supply conditions for the CDS and bond market may also drive a wedge between the spreads. The CDS premium is usually higher for less liquid underlying assets, as it is more costly for the protection seller to construct a hedge.

The CDS premium provides a direct measure of credit risks of the underlying reference entity, as it is not subject to the distortion of call features and other covenants that affect bond spreads. Given the standardised nature, the instrument allows comparisons of credit risk across countries, corporates and sovereigns (Cossin et al., 2002). The establishment of a credit derivatives market with diverse participants and high liquidity may enhance the efficiency of pricing risks.

Making use of market data collected for four Hong Kong corporates, Thailand and Malaysia, an empirical test is conducted to investigate the relationship among alternative measures of credit risk of reference entity and examine whether the CDS premium is a useful indicator for pricing credit risk and for market surveillance.[5]

There are many measures of credit risk for a given entity, such as the bond spread, the CDS premium and default probability. The bond spread is defined relative to the yield on a risk-free asset, approximated by the yield on US treasury bonds. The CDS premium is for 5-year maturity, as this is reportedly the most liquid market segment. The default probability refers to the expected default frequency (EDF) obtained from KMV. **Annex 1** provides details on the computation of EDF. Daily data during August 2001-August 2002 are covered for CDS and bond spreads. For EDF, daily data during May 2002-August 2002 are included.[6]

The test involves the examination of correlation among the three indicators of credit risk to assess their strength of association. A causality test is then applied to analyse the direction of the association. An indicator that is found to have caused movements in others can be considered as a leading indicator of the creditworthiness of the underlying entity.

---

[5] The sample size is small due to data limitations on long time series.

[6] We are grateful to Mr Simon Klassen of JP Morgan for providing the CDS spread data in Q3 2002 and Mr Shota Ishii of KMV for the series on EDF.

i. Correlation analysis

Strong positive correlation is found between the CDS premium and bond spread for all the sample entities. For most of the corporates, the CDS premium is also strongly correlated with the equity-derived EDF default probability.[7] The result is not surprising as all three series measure the credit risk of the same underlying entity in different ways. However, the correlation between CDS spread and default probability was relatively weak for one of the sample corporates. This is probably due to the more volatile prices of that company's stock that in turn raises its default probability.[8] In addition, the result may be affected by the illiquidity of that company's CDS, as evidenced by the high bid-ask spread.

ii. Granger causality tests

The Granger causality tests are employed to evaluate the direction of the relationship between the CDS premium, bond spread and default probability. As one of the requirements for the Granger causality test is that the time series must be stationary, unit root/stationarity tests are conducted on the series. The results seem to be inconclusive. When the standard Augmented Dickey-Fuller (ADF) test is used, all three variables for different entities showed unit roots in the level but not in the first-difference series, indicating that they are I(1) process (Granger, 1969). However, when using the stationarity test proposed by Kwiatkowski, Philips, Schmidt, and Shin (1992), some of the series are stationary.[9] On economic grounds, bond spreads, the CDS premium and default probabilities should be stationary.

The series in levels and in first-differences are therefore used to perform the Granger causality test. Both tests show that CDS spreads precede the movement of bond spreads for most of the entities.[10] This may be explained by the fact that commercial banks, which are major participants of the CDS market, are generally more informed than investors about the credit conditions of the reference

---

[7] Given the small sample size covered in the empirical test, only the general results are presented here.

[8] A rise in equity price volatility is in general associated with a higher asset value volatility, which would increase default probability.

[9] Kwiatkowski, et al. (1992) proposed a stationarity test on economic series with the null hypothesis that an observable series is stationary around a deterministic trend.

[10] First-differenced data should be used in causality tests if the variables are integrated of order one (Granger, 1980).

entities. They tend to buy more CDS for protection in the face of early signs of credit deterioration of the underlying asset. This action may then trigger the sale of bonds by other investors, leading to an increase in bond spreads.

The causality test shows inconclusive results on the relationship between the CDS premium and equity-based EDF. In a previous study by JP Morgan, credit spreads and EDF were found to have moved concurrently, as both credit and equity markets had simultaneous access to the same information (JP Morgan, September 2001).[11] However, the illiquidity of CDS markets compared with equity markets in most Asian economies may explain cases where the EDF led the CDS spread. Spreads of less liquid CDS may not reflect increases in bankruptcy risk in a timely manner. For the issuers of those instruments, the stock market may provide "early warning signals" of possible default, which are only reflected in CDS markets afterwards. That seems to apply to our sample, as the spread for CDS of two of the corporates, which are illiquid as evidenced by high bid-ask spreads, have EDF Granger-caused CDS spread in levels.

This empirical study shows that conditional on the liquidity of the market, CDS spreads can facilitate the price discovery process of credit risk and is useful for monitoring credit quality changes. The premium supplements stock and bond prices as an additional indicator for credit risk assessment and helps predict possible defaults. It is a particularly helpful indicator in assessing credit risks for sovereigns, which cannot be reflected by equity prices. Looking forward, as the CDS market matures, it may provide more discernible credit risk information for market surveillance purpose.

[11] The credit spread used by JP Morgan was asset swap spread, rather than spreads to government bonds, as the latter might be affected by scarcity premium especially in 1998.

2. Implications for Financial Market Stability

i. Benefits

The cross sector risk transfer market promotes risk diversification by allowing credit risk to be spread to a wider range of market participants, who are potentially in better positions to bear that risk. Such instruments seemed to have effectively dispersed losses from bankruptcies of large US corporates such as Enron and Global Crossing to a vast number of banks, insurance companies and other financial institutions, thereby helping to reduce systemic risk. A number of banks in the US noted that credit derivatives had helped them mitigate credit losses during periods of increased defaults (Ferguson, 2002). As such, the instruments have contributed to financial stability by reducing overall concentration of credit risk that can lead to systemic crises (IMF, March 2002).

It was argued that the rapid growth of the derivatives market in the past decade had facilitated the increase in cross-border capital flows (IMF, December 2002). Such instruments help investors manage their risks, making overseas investments more attractive. For instance, foreign banks will be more willing to increase exposure in emerging markets if they can hedge the credit risks with derivatives.

ii. Challenges

The use of credit derivatives tends to expand the linkages among markets and institutions, and in turn the potential for spillovers across markets. As risks are dispersed to a broader set of market participants through credit derivatives, market distress associated with default may spread more rapidly across institutions and markets through counterparty relationships. In times of increased credit defaults, for example, a number of insurance companies which sell risk protection may simultaneously tap funds from the banking system to finance payments on credit derivatives contracts. In case of financial difficulty for a major protection seller, the associated credit derivatives contracts may fail to perform, leaving protection buyers unhedged against their credit exposures (IMF, March 2002). While banks can buy credit protection from insurance companies, the risks may be transferred back to the banking sector through borrowing. In addition, the current market for credit derivatives is highly concentrated with a few dominant players. The resulting concentration may risk triggering systemic problems during periods of market stress, if one major player fails.

Credit derivatives also reduce the transparency of overall distribution of risk across institutions and across markets. As some transactions are shifted off-balance sheet through credit risk transfer, creditors may be vulnerable to risks that cannot be assessed easily through financial statement analysis (Greenspan, 2002). When risks are transferred to unregulated reinsurers or offshore centres, financial market regulators would face difficulties in tracking the scale and direction of risk redistribution and assessing whether adequate capital has been held against the risks (FSA, 2002).

The risk structure of financial institutions will be complicated by their regulatory arbitrage activity, raising supervisory concerns. As mentioned in Section II, banks have incentives to transfer high quality loans to other banks to free up capital for higher-margin business, as they considered the capital requirements too high for those exposures. The Basle Committee on Banking Supervision has therefore proposed a new capital-adequacy framework that should reduce the incentive for regulatory arbitrage by relying heavily on banks' internal estimates of borrower creditworthiness for setting capital charges (Secretariat of the Basle Committee on Banking Supervision, 2001).

Local monitoring incentives for banks may be reduced when credit derivatives are purchased. The originating bank of a loan is in the best position to oversee the ongoing financial condition of the borrower. However, the bank may shirk the responsibility of monitoring after it purchases credit protection (Kiff and Morrow, 2000).

Investors (protection sellers) can use unfunded instruments like CDSs to establish leveraged positions. They are thus prone to inducing speculative excesses, which may potentially amplify financial market volatility (Greenspan, 2002).

Market participants are confident of the continued development of the credit derivatives market as the vehicles have proven their significance in enhancing efficiency in risk transfer and pricing, especially in times of economic downturn, when rising bankruptcies, defaults and debt restructuring increase demand for hedging products. The Russian default, the terrorist attack in the US, the default of Argentina, the collapse of Enron and other corporate scandals in the past years, on the one hand, increased concern about debt defaults, stressing the importance of liquid instruments to hedge and trade sovereign and corporate risks. On the other hand, the incidents provided an important test for risk transfer markets, highlighting the problems of inconsistent definition and documentation of credit derivatives contracts, which prompted market organisations to review and standardise the relevant terms, helping the development of the products.

IV. CONCLUDING REMARKS

This paper examines the current status of the credit derivatives market and its effect on financial market functioning and stability. It highlights the main products, participants, structure, mechanics of risk transfers, and factors contributing to the rapid growth of this market.

The development of the credit derivatives market will likely improve the efficiency of credit risk pricing and provides information that supplements bond and stock prices to reflect risk of possible defaults. Credit risk transfer can enhance the stability of the financial system through risk diversification. It also has the potential to enhance the overall market liquidity by improving the ability of market participants to optimise their exposure to credit risk. The increase in inter-linkages among financial institutions may, however, exemplify potential market instability. Credit risk transfer activity also complicates the assessment of credit exposure.

Looking forward, improvements to the infrastructure for, and transparency of, credit risk transfers will facilitate the further development of the credit risk transfer market. Reporting requirements may have to be reviewed to ensure that regulators can capture the key risks about the investment activities of market participants. Better information about the size and structure of the credit derivative market and the exposures of bank and non-bank financial institutions active in the market would help market participants assess the risks. The diversion of risk through the use of credit derivatives by various institutions also demonstrates increasing need for supervisors in different sectors to share information about risk management practices. Supervisory authorities need to ensure financial institutions have in place adequate risk management systems to support the credit risk transfer activity.

Annex 1

Expected Default Frequency (EDF) Credit Measure

The EDF credit measure by KMV shows the probability that a company will default on its debt obligations within a given time horizon. The model assumes that the default risk of a firm increases as the value of the assets approaches the book value of the liabilities. While some firms default when their assets reach the book value of total liabilities, many of them continue to trade and service their debt until the asset value decreases to a particular level, namely the *default point*. The point is calculated as a firm's current liabilities plus half of the firm's long-term liabilities, subject to a lower bound. The *distance to default* ratio is the number of standard deviations of the firm's asset value to its *default point* for a given horizon. It is calculated as:

$$= \frac{\text{Market value of assets} - \text{Default point}}{\text{Market value of assets x Asset value volatility}}$$

where:

Market value of assets equals the market value of a company's equity plus its liabilities. It is expressed as:

= Market capitalisation x Conversion multiplier + Current liabilities +
[Long-term liabilities + Preferred stock] x Option-theoretic factor

- Market capitalisation represents the market value of equity.

- The conversion multiplier measures the total number of common shares after all convertible securities are converted. It is typically between 1.0 and 1.1.

- The option-theoretic factor is used to transform the par value into market value of long-term liabilities and preferred stocks, which is not observable.[12] Debt holders

[12] The factor is derived from the option pricing model, where the value of equity is viewed as a call option on the value of a firm's assets (Crosbie, 2001).

are compensated for default risk in a fair market, and the option-theoretic factor reflects such risk, which should also be taken into account when estimating how much the market is willing to pay for the long-term liabilities and preferred stocks. As current liabilities are similar to cash immediately payable, no adjustment is made on the item.

Asset value volatility is a measure of the business risk of a firm, calculated by the standard deviation of the annual percentage change in the market value of the firm's assets. The higher the asset volatility, the less certain investors are about the market value of the firm. It is estimated based on the market value and volatility of equity and book value of liabilities using the option pricing based approach mentioned above.

The distance-to-default is used to calculate *default probabilities* based on an empirical default distribution, which maps a distance-to-default value to an EDF. The distance-to-default has an inverse relationship with default probability. The distribution is obtained from data of historical default. For example, to get the default probability over the next year for a firm that is 7 standard deviations away from default, KMV checks the default history for the proportion of the firms, 7 standard deviations away from default that defaulted over the next year (Tse, 2002).

REFERENCES

Altman, Edward I, *Corporate Credit Scoring Models: Approaches and Tests for Successful Implementation,* Journal of Commercial Bank Lending, Stern School of Business, New York University, May 1995

Bank for International Settlements (BIS), *Risk Management Practices and Regulatory Capital: Cross Sectoral Comparison,* November 2001

BIS, *Credit Risk Transfer*, January 2003

British Bankers' Association, Credit Derivatives Survey 1999/2000, 2001/2002

Cossin, Didier, Daniel Aunon-Nerin, Tomas Hricko and Zhijiang Huang, *Exploring for the Determinants of Credit Risk in Credit Default Swap Transaction Data : Is Fixed-Income Markets' Information Sufficient to Evaluate Credit Risk?,* 2002

Credit Suisse First Boston, *CreditRisk+*, 1997

Crosbie, Peter and Jeffrey Bohn, *Modelling Default Risk, KMV*, May 2001

Financial Services Authority (FSA), *Cross-sector risk transfers*, May 2002

Ferguson, Roger W, *Financial Engineering and Financial Stability*, BIS Review 67, 2002

Granger, C. W. J., *Investigating Casual Relationships by Economic Models and Cross Spectral Models*, Econometrica, 1969

Granger, C.W.J., *Testing for Causality: A Personal Viewpoint*, Journal of Economic Dynamics and Control, 1980

Greenspan, Alan, *International Financial Risk Management*, BIS Review 67, 2002

Hong Kong Monetary Authority (HKMA), *Supervisory Policy Manual: Credit Derivatives*, June 2001

HKMA, *Results of the 2002 Survey on Credit Derivatives Activity*, HKMA Quarterly Bulletin, June 2003

International Monetary Fund (IMF), *Stability Implications of Global Financial Market Conditions,* Global Financial Stability Report, March 2002

IMF, *Local Derivatives Markets and Capital Flows to Emerging Market Economies,* Global Financial Stability Report, December 2002

Ishii, Shota, Presentation on Quantitative Credit Risk Management: An Introduction to Moodys KMV Technology, 2002

JP Morgan, *Introduction to CreditMetrics*, April 1997

JP Morgan*, Guide to Credit Derivatives*, 1999

JP Morgan, *Credit Default Swap in Asia*, February 2002

JP Morgan, *Debt versus Equity, Is it possible to keep both investor groups happy?* May 2002

Kiff, John and Ron Morrow, *Credit Derivatives*, Bank of Canada Review, autumn 2000

Kern, Markus and Bernd Rudolph, *Comparative Analysis of Alternative Credit Risk Models*, 2001

Kwiatkowski, D., P. Philips, P. Schmidt and Y. Shin, *Testing the null hypothesis of stationarity against the alternative of a unit root* Journal of Econometrics 54, 1992

Marsh, Ian, *What Central Bank can Learn about Default Risks from Credit Markets,* Bank for International Settlements (BIS) papers No 12, August 2002

Rule, David, *The credit derivatives market: its development and possible implications for financial stability*, Bank of England Financial Stability Review, June 2001

Secretariat of the Basle Committee on Banking Supervision, *The New Basle Capital Accord: an explanatory note*, January 2001

Tse, Terry, *A Non-quantitative Introduction to EDF's*, 2002