APPENDIX A

Complex Financial Products

This appendix provides background information on three classes of instruments: credit derivatives, structured credit and equity derivatives. Each instrument review has four components: instrument description and market developments, forces driving market activity, long and short users of the instruments and risk management issues. To place the discussion in perspective, the analysis begins with background material regarding leverage which is drawn primarily from the 1999 CRMPG I report.

A. Background on Leverage

To varying degrees, the instruments that are the subject of the reviews below — as well as other instruments spawned by recent innovation — incorporate leverage. CRMPG I explained that leverage exists whenever an entity is exposed to changes in the value of an asset over time without having first disbursed cash equal to the value of that asset at the beginning of the period. A major contribution of the report was that it demonstrated why the impact of leverage can only be understood by relating the underlying risk in a portfolio to the economic and funding structure of the portfolio as a whole. The report provided an analytical framework for understanding how leverage affects market risk, funding risk and asset liquidity risk.

The starting point for analysis in CRMPG I was that financial institutions can fail in at least two ways. The first is through capital insolvency, meaning their liabilities exceed assets. Simple measures of leverage relate a notional or gross exposure to book equity but do not shed light on the probability of change occurring or the likely magnitude of change in portfolio value. The report defined risk measures which attempt to estimate the potential for capital insolvency as measures of leverage. Under such measures, two portfolios of like size can show quite different risk profiles. For example, a leveraged portfolio of low-risk assets may have less aggregate risk than an unleveraged portfolio of high-risk assets.

The second way firms can fail is through liquidity insolvency, meaning they run out of cash and are unable to raise new funds. The report defined measures which attempt to estimate the potential for a firm to run out of cash as measures of funding liquidity.

A key observation here was that a firm will have a higher degree of funding liquidity risk if it must meet additional margin calls to cover losses on assets used to secure funding and if it has a large portfolio relative to its funding sources. In other words, funding could be depleted faster for a given change in asset values. The report went on to point out that, generally, funding sources scale with capital, so increased leverage amplifies funding liquidity risk.

Asset liquidity risk in CRMPG I referred to the risk that the liquidation value of assets may differ significantly from their current mark-to-market values. This risk is of particular concern for highly leveraged portfolios because such portfolios may accumulate larger positions for a given level of capital. In the event of an adverse market environment, the likelihood that such a liquidation might occur is greater for such a portfolio as is the potential market impact. The report highlighted the dangers of assuming that all positions could be liquidated in the same time period and recommended adjusting risk measures for varied liquidation horizons.

Ultimately, CRMPG I enhanced understanding of how the confluence of leverage, funding liquidity risk and asset liquidity risk for an individual firm can give rise to systemic concerns in adverse market environments.

When considering the leverage features of the instruments reviewed below it is helpful to distinguish the more commonly thought of financial sources of leverage from the various other ways the instruments can amplify the volatility of returns. Traditional sources of financial leverage include, for example:

- Borrowing — investing one dollar and borrowing two dollars for a total investment of three dollars.
- Initial Margin — by putting up a small amount of initial margin the investor can obtain exposure to a large number of contracts, e.g., futures.
- No Initial Margin — gaining exposure to the change in value of reference variable or asset without necessarily posting money upfront, e.g., derivatives.

The instruments associated with recent product innovation can incorporate leverage in a variety of ways, including through credit, duration and optionality embedded in the instruments. Leverage in certain transactions emanates from the fact that the investor can gain exposure to the performance of a single asset or pool of assets by investing in contracts with payout terms linked to the performance of the underlying

assets or in tranches which prioritize the returns on reference assets across different classes of investors. An investor could leverage himself or herself financially to potentially amplify returns or invest in something that itself embeds leverage, or do a combination of both.[6] For example, an investor could buy $3 million of bonds across several issuers or the investor could buy the $3 million equity tranche of a CDO, thereby gaining exposure to the riskiest part of a $100 million portfolio of bonds that includes the same issuers. With the latter investment, the investor assumes the risk of faster loss accumulation but is presumably being compensated for the risk by gaining access to the returns of a much larger portfolio.

B. Credit Derivatives

1. Instrument Description and Market Developments

A credit derivative is a financial contract that allows a market participant to take or reduce default exposure, generally on bonds or loans, to a sovereign or corporate entity. The contract is between two parties and does not directly involve the issuer itself.

Credit derivatives are primarily used to:

- Reduce risk arising from ownership of bonds or loans;
- Take exposure to an entity, as one would do by buying a bond or loan;
- Express a positive or negative credit view on a single entity or a group of entities, independent of any other exposures to the entity one might have.

Since its introduction in the mid-1990s, the growth of the credit derivative market has been dramatic:

- The notional amount of credit derivative contracts outstanding at the end of 2003 stood at $3.5 trillion, up 82% from 2002.[7] At the end of 2004, outstanding contracts were estimated to be $5 trillion.

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[6] Leverage can be increased when there is a combination of financial leverage and leverage embedded in an instrument. For example, some levered investments such as equity tranches of synthetic transactions are also being done in swap form in which collateral posting is less than the notional.

[7] British Bankers' Association estimates.

- The tremendous growth in the credit derivatives market has been driven by the diversification of participants, the standardization of documentation and the growth of product applications.

- Credit derivatives have become mainstream and are integrated with credit trading and risk management at many firms.

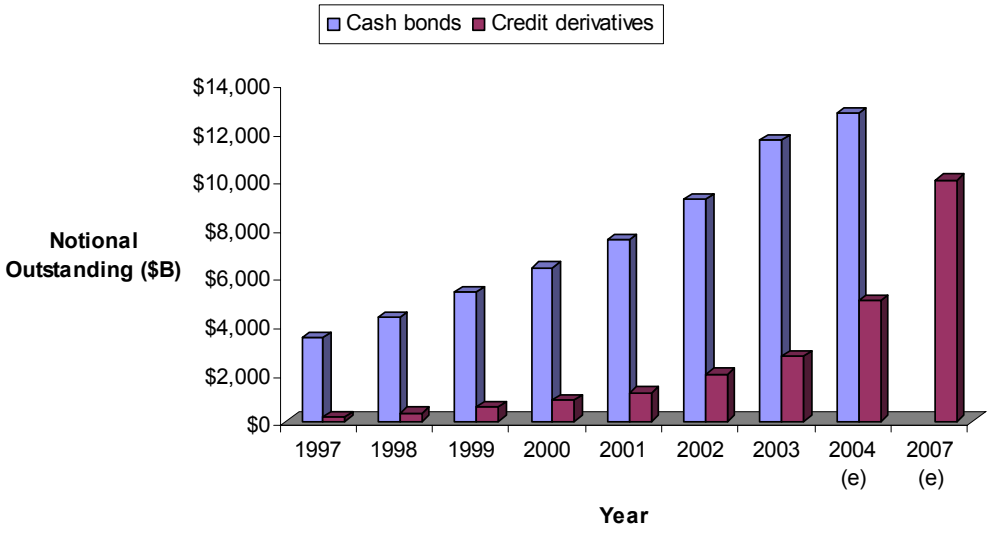
- ISDA's standard contract has generally proven effective, including in significant credit market events. When WorldCom filed for bankruptcy in July 2002, there were 600 CDS contracts outstanding in the marketplace, accounting for over $7 billion in notional terms. When Parmalat SPA defaulted in December 2003, there were approximately 4,000 CDS contracts and $10 billion outstanding in the marketplace. Additionally, Parmalat was a component of the original Trac-x Series 1 credit index. In December 2003, trading volumes in Trac-x increased three to four times after the Parmalat default, and over 550 Trac-x contracts settled. In these situations, contracts were settled without settlement problems, disputes or litigation. Legal and operational issues have been experienced in this market, however. These issues are discussed in Section IV of the main CRMPG II Report and in Section B.4 below.

- With the movement toward electronic settlement of CDS trades using DTCC (similar to the practice in the bond market), the logistics of trading credit derivatives is simplified. It is important to note, however, that the DTCC service is new and the associated volumes still relatively small.

- One large financial intermediary estimates that single-name credit default swaps represent about 60% of the total volume of credit derivatives traded, while credit derivative index products represent about 25%. Options, first-to-default baskets, synthetic CDOs and tranched credit products account for the remaining 15% of the credit derivatives market. (See Section C below for additional information on these market segments.)

- The variety of products is growing along with the sophistication of users. Recent additions to the credit derivatives product suite allow for the trading of spread volatility, correlation and spread curves, as well as specific components of credit risk such as recovery rates.

Chart 1
Credit Derivatives Volumes Continue to Grow Rapidly and Are an Increasing Portion of Total Debt Outstanding



Sources: British Bankers' Association, Bank for International Settlements

The credit default swap (CDS) is the cornerstone of the credit derivatives market. A credit default swap is an agreement between two parties to exchange the credit risk of an issuer (reference entity). The buyer of the credit default swap is said to buy protection. The buyer usually pays a periodic fee and profits if the reference entity has a credit event, or if the credit worsens while the swap is outstanding. A credit event includes bankruptcy, failing to pay outstanding debt obligations or, in some CDS contracts, a restructuring of a bond or loan. Buying protection has a similar credit risk position to selling a bond short, or "going short risk."

The seller of the credit default swap is said to sell protection. The seller collects the periodic fee and profits if the credit of the reference entity remains stable or improves while the swap is outstanding. Selling protection has a similar credit risk position to owning a bond or loan, or "going long risk."

Other noteworthy aspects of the credit default swap market include:

- The most commonly traded and therefore the most liquid tenors for credit default swap contracts are five and ten years. Historically, volumes are concentrated in the five-year maturity. One large financial intermediary

estimates that 70% of the CDS volume is in this tenor, with 20% in longer maturities and 10% in shorter maturities. Liquidity across the maturity curve continues to develop, however, demonstrated by CDX indices, which are quoted in the 1, 2, 3, 4, 5, 7, and 10 year tenors.

- Standard trading sizes vary depending on the reference entity. For example, in the US, $10 million – $20 million notional is typical for investment grade credits, and $2 million – $5 million notional is typical for high yield credits. In Europe, €10 million notional is typical for investment grade credits, and €2 million – €5 million notional is typical for high yield credits.

Credit default swap indices provide investors with a single, liquid vehicle through which to take diversified long or short exposure to a specific credit market or market segment. The first index product was the High Yield Debt Index (HYDI), created by JPMorgan in 2001. Like the S&P 500 and other market benchmarks, the credit default indices reflect the performance of a basket of credits, namely a basket of single-name credit default swaps (credit default swaps on individual credits). CDS indices exist for the US investment-grade and high-yield markets, the European investment-grade and high-yield markets, the Asian markets and global emerging markets.

Unlike a perpetual index like the S&P 500, CDS indices have a fixed composition and fixed maturities. New indices with an updated basket of underlying credits are launched periodically, at least twice a year. New indices are launched in order to reflect changes in the credit market and to give the index more consistent duration and liquidity. When a new index is launched (dubbed the "on-the-run index"), the existing indices continue to trade (as "off-the-run") and will continue to trade until maturity. The on-the-run indices tend to be more liquid than the off-the-run indices.

Probably the most important event in the CDS market in 2004 was the establishment of one credit derivative index family. The establishment of the Dow Jones CDX index family in the US and the Dow Jones iTraxx index family in Europe and Asia in the second quarter has led to increased liquidity in index products and the growth of other products (volatility, correlation) that require a standard, liquid underlying market. In DJ CDX Investment Grade and High Yield,

bid/offer spreads have halved due to the liquidity benefit of having one single index family, and transaction volumes have increased.

2. Forces Driving Market Activity

Credit derivatives have been widely adopted by credit market participants as a tool for managing exposure to, or investing in, credit. The rapid growth of this market is largely attributable to the following features of credit derivatives:

(a) Credit derivatives allow the disaggregation of credit risk from other risks inherent in traditional credit instruments

A corporate bond represents a bundle of risks including interest rate, currency (potentially) and credit risk (constituting both the risk of default and the risk of volatility in credit spreads). Before the advent of credit default swaps, the primary way for a bond investor to adjust his credit risk position was to buy or sell that bond, consequently affecting his positions across the entire bundle of risks. Credit derivatives provide the ability to independently manage default risk.

(b) Credit derivatives provide an efficient way to short a credit

While it can be difficult to borrow corporate bonds on a term basis or enter into a short sale of a bank loan, a short position can be easily achieved by purchasing credit protection. Consequently, risk managers can short specific credits or a broad index of credits, either as a hedge of existing exposures or to profit from a negative credit view.

(c) Credit derivatives create a market for "pure" credit risk that allows the market to transfer credit risk to the most efficient holder of risk

Credit default swaps represent the cost to assume "pure" credit risk. Bond, loan, equity and equity-linked market participants may transact in the credit default swap market. Because of this central position, the credit default swap market will often react faster than the bond or loan markets to news affecting credit prices. For example, investors buying newly issued convertible debt are exposed to the credit risk in the bond component of the convertible instrument, and may seek to hedge this risk using credit default swaps. As buyers of the convertible bond purchase protection, spreads in the CDS

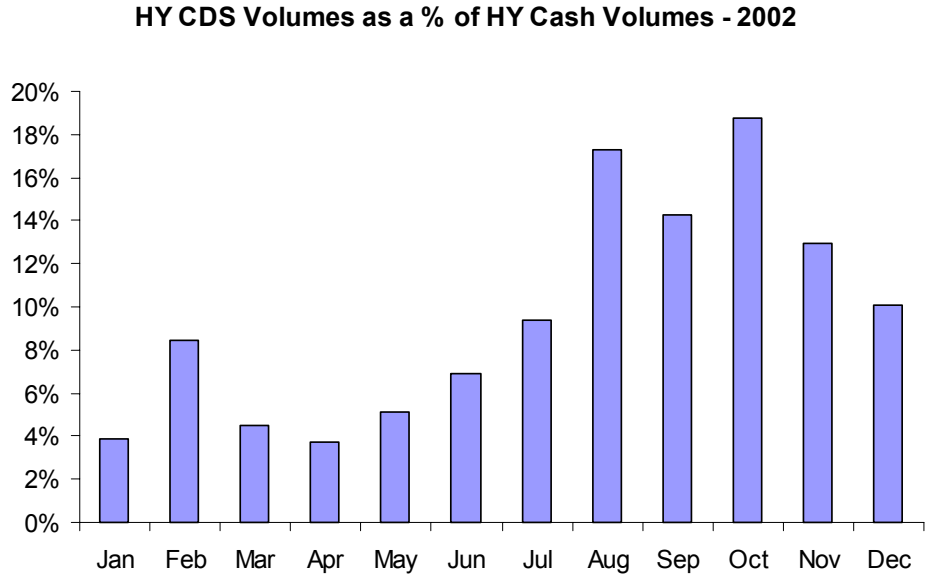
market widen. This spread change may occur before the pricing implications of the convertible debt are reflected in bond market spreads. However, the change in CDS spreads may cause bond spreads to widen as investors seek to maintain the value relationship between bonds and CDS. Thus, the CDS market can serve as a link between structurally separate markets. This has led to more awareness of and participation from different types of investors.

(d) Credit derivatives can provide additional liquidity in times of turbulence in the credit markets

The credit derivative market can provide additional liquidity during periods of market distress (high default rates). Before the credit default swap market, a holder of a distressed or defaulted bond often had difficulty selling the bond, even at reduced prices. This is because cash bond desks are typically long risk as they own an inventory of bonds. As a result, they are often unwilling to purchase bonds and assume more risk in times of market stress. In contrast, credit derivative desks typically hold an inventory of protection (short risk), having bought protection through credit default swaps. In distressed markets, investors may be able to reduce long risk positions by purchasing protection from credit derivative desks, which may be better positioned to sell protection (long risk) and change their inventory position from short risk to neutral. Furthermore, the CDS market creates natural buyers of defaulted bonds, as protection holders (short risk) buy bonds to deliver to the protection sellers (long risk). CDS markets, therefore, have tended to increase liquidity across many credit market segments.

As the chart below illustrates, CDS volumes as a percentage of cash volumes increased steadily during the distressed spring and summer of 2002 in the face of credit-spread volatility and corporate defaults.

Chart 2
The CDS Market Remained Liquid During the Turbulent Second Half of 2002



Source: JPMorgan

(e) Credit derivatives provide ways to tailor credit investments and hedges

Credit derivatives provide users with various options to customize their risk profiles. Through the CDS market, investors may assume exposure to credits that do not actively trade in the cash market, customize tenor or currency exposure or benefit from relative value transactions between credit derivatives and other asset classes. With credit derivatives, investors have access to a variety of structures, such as baskets and tranches, that can be used to tailor investments to suit the investor's desired risk/return profile. As an example, investors who purchase risk through synthetic baskets of credits may attempt to hedge this risk by purchasing single-name credit default swaps. This can be a significant driver of single-name CDS volumes.

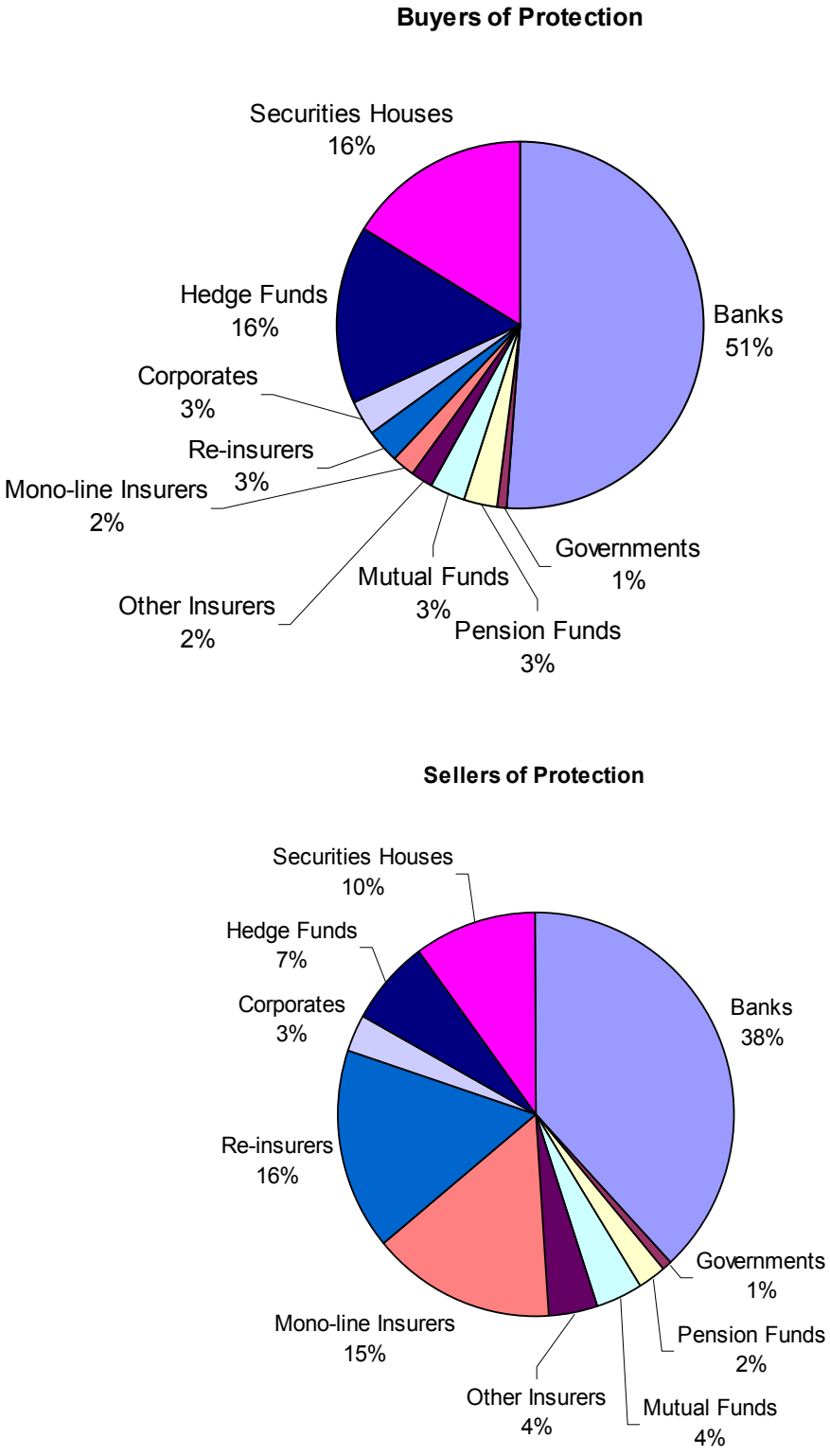
(f) Credit derivative transactions are confidential

As with the trading of a bond in the secondary market, the reference entity whose credit risk is being transferred is neither a party to a credit derivative transaction nor is even aware of it. This confidentiality enables risk managers

to isolate and transfer credit risk discreetly, without affecting business relationships. In contrast, a loan assignment through the secondary loan market may require borrower notification and may require the participating bank to assume as much credit risk to the selling bank as to the borrower itself. Because the reference entity is not a party to the negotiation, the terms of the credit derivative transaction (tenor, seniority and compensation structure) can be customized to meet the needs of the buyer and seller, rather than the particular liquidity or term needs of a borrower.

Over the last few years, participants' profiles have evolved and diversified along with the credit derivatives market itself. While banks remain important players in the credit derivatives market, asset managers are increasingly a source of growth in activity.

Chart 3
CDS Market Participants



Source: British Banker's Association Credit Derivatives Report 2003/2004

3. Long and Short Users

The following is a brief summary of strategies employed by the key players in the credit derivatives market:

(a) Banks and loan portfolio managers

Banks were once the primary players in the credit derivatives market. They developed the CDS market in order to reduce their risk exposure to companies to whom they lent money, thereby reducing the amount of capital needed to satisfy regulatory requirements. Banks continue to use credit derivatives for hedging both single-name and broad market credit exposure.

(b) Market makers

In the past, market markers in the credit markets were constrained in their ability to provide liquidity because of limits on the amount of credit exposure they could have on one company or sector. The use of more efficient hedging strategies, including credit derivatives, has helped market makers trade more efficiently while employing less capital. Credit derivatives allow market makers to hold their inventory of bonds during a downturn in the credit cycle while remaining neutral in terms of credit risk. To this end, a number of dealers have integrated their CDS trading and cash trading businesses.

(c) Hedge funds

Since their early participation in the credit derivatives market, hedge funds have continued to increase their presence and have helped to increase the variety of trading strategies in the market. While hedge fund activity was once primarily driven by convertible bond arbitrage, many funds now use credit default swaps as the most efficient method to buy and sell credit risk. Additionally, hedge funds have been the primary users of relative value trading opportunities and new products that facilitate the trading of credit spread volatility, correlation and recovery rates.

(d) Asset managers

Asset managers have significantly increased their participation in the credit derivatives market in recent years. Asset managers are typically end users of risk that use the CDS market as a relative value tool, or to provide a structural

feature they cannot find in the bond market, such as a particular maturity. Also, the ability to use the CDS market to express a bearish view is an attractive proposition for many asset managers. Prior to the availability of CDS, an asset manager would generally be flat or underweight in a credit they did not like, as most were unable to short bonds in their portfolios. Now, many asset managers may also buy credit protection as a way to take a short-term neutral stance on a credit while taking a bullish longer term view. For example, an asset manager might purchase three-year protection to hedge a ten-year bond position on an entity where the credit is under stress but is expected to perform well if it survives the next three years. Finally, the emergence of a liquid CDS index market has provided asset managers with a vehicle to efficiently express macro views on the credit markets.

(e) Insurance companies

The participation of insurance companies in the credit default swap market can be separated into two distinct groups: (1) life insurance and property & casualty (P&C) companies and (2) monolines and reinsurers. Life insurance and P&C companies typically use credit default swaps to sell protection to enhance the return on their asset portfolio either through Replication (Synthetic Asset) Transactions ("RSATs" or the regulatory framework that allows some insurance companies to enter into credit default swaps) or credit-linked notes. Monolines and reinsurers often sell protection as a source of additional premium and to diversify their portfolios to include credit risk.

(f) Corporations

Corporations are recent entrants to the credit derivatives market and promise to be an area of growth. Most corporations focus on the use of credit derivatives for risk management purposes, though some invest in CDS indices and structured credit products as a way to increase returns on pension assets or balance sheet cash positions.

Recent default experiences have made corporate risk managers more aware of the amount of credit exposure they have to third parties and have caused many to explore alternatives for managing this risk. Many corporate treasury and credit officers find the use of CDS appealing as an alternative to credit

insurance or factoring arrangements due to the greater liquidity, transparency of pricing and structural flexibility afforded by the CDS market. Corporations are also focused on managing funding costs; to this end, many corporate treasurers monitor their own CDS spreads as a benchmark for pricing new bank and bond deals and are exploring how the CDS market can be used to hedge future issuance.

4. Risk Management Issues

The risk profile of a credit default swap is essentially equivalent to the credit risk profile of a bond or loan, with some additional risks, namely counterparty risk, basis risk, legal risk and operational risk.

(a) Counterparty risk

Recall that in a credit event, the buyer of protection (short risk) delivers bonds of the defaulted reference entity, or other eligible assets, and receives par from the seller (long risk). Therefore, an additional risk to the protection buyer is that the protection seller may not be able to pay the full par amount upon default. This risk, referred to as counterparty credit risk, is a maximum of par less the recovery rate, in the event that both the reference entity and the counterparty default. While the likelihood of suffering this loss is remote, the magnitude of the loss given default can be material. Counterparties typically mitigate this risk through the posting of collateral (as defined in a credit support annex (CSA) to the ISDA Master Agreement) rather than through the adjustment of the price of protection.

(b) Basis risk

Basis refers to the difference, in basis points, between a credit default swap spread and a bond's par equivalent CDS spread with the same maturity dates. Basis is either zero, positive or negative.

If the basis is negative, then the credit default swap spread is lower than the bond's spread. This occurs when there is excess protection selling (investors looking to go long risk and receive periodic payments), reducing the CDS coupon. Excess protection selling may come from structured credit issuers (or CDO issuers), for example, who sell protection in order to fund coupon payments to the buyers of structured credit products. Protection selling may

also come from investors who lend at rates above Libor. For these investors, it may be more economical to sell protection and invest at spreads above Libor rather than borrow money and purchase a bond.

If the basis is positive, then the credit default spread is greater than the bond's spread. Positive basis occurs for technical and fundamental reasons. The technical reasons are primarily due to imperfections in the repo market for borrowing bonds. Specifically, if cash bonds could be borrowed for extended periods of time at fixed costs, then there would not be a reason for bonds to trade "expensive" relative to credit default swaps. If a positive basis situation arises, investors would borrow the bonds and sell them short, eliminating the spread discrepancy. In practice, there are significant costs and uncertainties in borrowing bonds. Therefore, if the market becomes more bearish on a credit, rather than selling bonds short, investors may buy default protection. This may cause credit default swap spreads to widen compared with bond spreads.

Another technical factor that causes positive basis is that there is, to some degree, a segmented market between bonds and credit default swaps. Regulatory, legal and other factors prevent some holders of bonds from switching between the bond and credit default swap markets. These investors are unable to sell a bond and then sell protection when the credit default swap market offers better value. Along this vein of segmented markets, sometimes there are market participants, particularly coming from the convertible bond market, who wish to short a credit (buy default swap protection) because it makes another transaction profitable. These investors may pay more for the protection than investors who are comparing the bonds and credit default swap markets. This is another manifestation of the undeveloped repo market.

A fundamental factor that creates positive basis is the cheapest-to-deliver option. A short CDS position (long risk) is short the cheapest-to-deliver option. If there is a credit event, the protection buyer (short risk) is contractually allowed to choose which bond to deliver in exchange for the notional amount. This investor will generally deliver the cheapest bond in the market. When there is a credit event, bonds at the same level of the capital structure generally trade at the same price (except for potential differences in

accrued interest) as they will be treated similarly in a restructuring. Still, there is the potential for price disparity. Thus, protection sellers may expect to receive additional spread compared to bonds for bearing this risk. This would lead to CDS spreads trading wider than bond spreads and therefore contribute to positive basis. Thus, when investors invest in credit default swaps, they risk entering into a position that is relatively expensive as compared to entering into a similar risk position with bonds or loans.

(c) Legal risk

Credit default swaps investors may face legal risk if there is a credit event and the legality of the CDS contract is challenged. Although not without specific disputes, as previously stated, ISDA's standard contract has generally proven effective in the face of significant credit market stress. The large majority of contracts have tended to settle without disputes or litigation. As discussed in Section IV of the main CRMPG II Report, legal issues can and do arise in this market from time to time. Most of these disputes have involved contractual claims related to whether there was a credit event under the terms of the contract, the identity of the reference entity, the timeliness of notices delivered under the contract, the nature of the assets deliverable into the contract and the timeliness of the delivery of assets for settlement purposes.

(d) Operational risk

With limited straight through processing, confirmation backlogs, and a clearing service in relatively early stages of operation, back offices have tended to feel the strain of handling a rapidly growing volume of activity. The recent credit event in which gross positions in the reference entity exceeded the available deliverable assets highlighted the potential difficulty for market participants in settling transactions in a timely and efficient manner. Section IV of the main CRMPG II Report addresses these issues more fully.

Other risk considerations:

- Credit default swaps are leveraged transactions. Unlike a transaction related to floating rate notes or corporate bonds with a similar amount of credit risk, principal amount is not exchanged upfront in a CDS. As noted above, large and/or sophisticated counterparties typically

mitigate the risk of non-performance by the daily updating of collateral accounts reflecting gains or losses on positions.

- Credit default swaps are over-the-counter transactions between two parties and it is difficult to estimate the amount of default swaps which are outstanding. While the net amount of all credit default swaps is zero, as the amount of long protection positions must be equal to the short protection position, there may be market participants who are very long or short exposure to specific credits.

- In marking the value of an open credit default swap to market, investors must estimate a recovery rate. If investors deviate from industry standard recovery rates, they can calculate different values for their open contracts.

This section should provide a helpful foundation for understanding the issues around the second product review: structured credit.

C. Structured Credit

1. Instrument Description and Market Developments

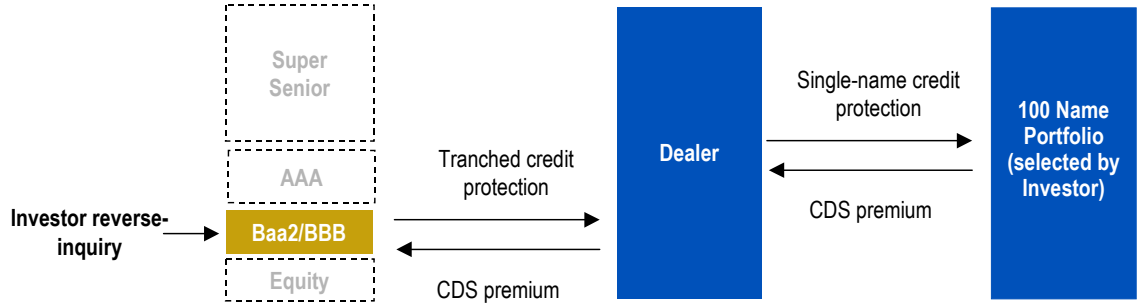
The structured credit market has existed since 1988, and issuance began in earnest in 1997. The last two years, however, has seen the transformation of the market from a niche sector to a core asset class within fixed income. In some ways, this transformation can be attributed to a maturing market with improved liquidity and transparency, established analytic platforms, increased standardization, increased acceptance of credit derivatives technology and a growing track record. But what has truly pushed structured credit into the mainstream is a growing understanding by investors motivated to increase yields in the current low-spread environment. Structured credit still offers a spread pick-up versus nearly all other like-rated credit products, although that premium is diminishing.

The structured credit market can be broadly separated into synthetic and cash instruments.

- **Synthetics:** Each vehicle sources exposure to a pool of pure credit risk using credit default swaps (CDS) on 100 or more single-names. Risk is

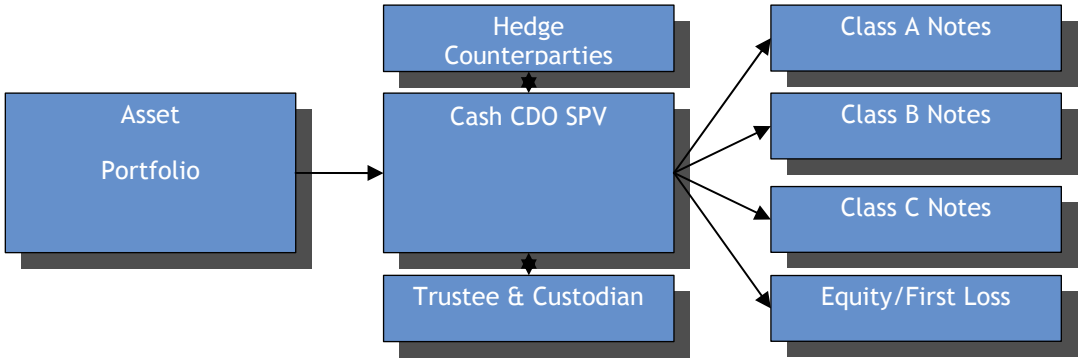
tranched into distinct attachment and detachment points, meaning that investors can customize any number of loss exposures. Most pools are referenced to single-A/BBB corporate credits, although asset-backed securities (ABS) may also be referenced. Equity leverage is typically 20-30x, and deals generally have maturities of five to ten years, depending on the maturity of the underlying CDS. In most synthetics, like the one depicted in Chart 4 below, the motivation for issuance has shifted from issuer balance sheet risk management (early deals) to investor desire to take on a customized risk profile (current deals).

Chart 4
Indicative Synthetic CDO (Baa2/BBB Tranche)



- **Cash:** Cash CDOs gain exposure to credit risk via a bankruptcy remote special purpose vehicle that purchases a diversified pool of cash assets (100+ names). The portfolio is generally managed by a third party but may be static in some cases. Risk is tranched into various loss exposures with customized structures. Each structure contains extensive rules that restrict asset exposures and triggers that that help protect the notes if the collateral deteriorates. Weighted average lives are typically 7 to 12 years.

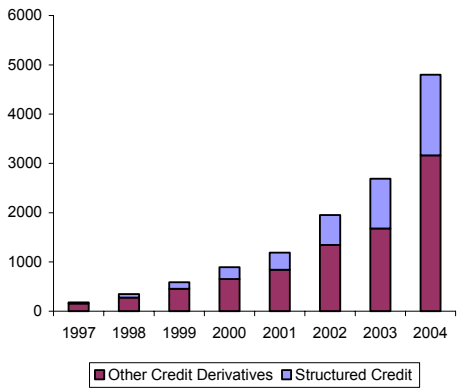
Chart 5
Indicative Cash CDO



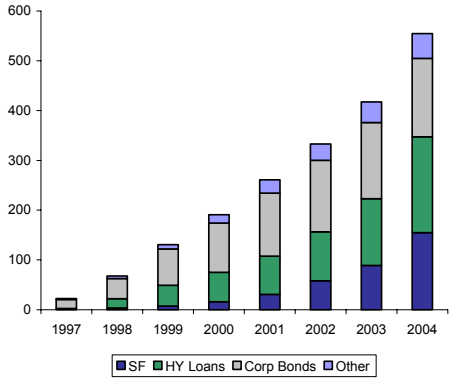
Synthetic issuance can be measured either by the amount of risk actually distributed to investors (approximately $700 billion globally), or the amount of single-name CDS sold to support this issuance (approximately $1.6 trillion globally). The latter number is more often cited in the market and can be thought of as the delta equivalent of the former, thereby illustrating the leverage in the transactions. In the cash market, outstanding risk is approximately $550 billion globally.

Chart 6

Total Outstanding Global Credit Derivatives Volume ($bn)



Total Outstanding Global Cash CDOs by Sector ($bn)



Source: JPMorgan

The synthetic market is composed of several types of transactions.

- **Tranched Index Trades:** One of the most standardized and easy to understand products in the structured credit market, the portfolio is linked

to an index such as DJ TRAC-X. It references a static portfolio with standardized attachment points. Market inception was 2003.

- **Bespoke:** The portfolio is chosen by the investor, and is generally static but may have limited substitution rights. There may be customized or standardized attachment points. Market inception was 2002.

- **First to Default Swaps:** These tend to be based on smaller portfolios than other structured credit trades (five names). The investor receives periodic spread until the first credit event occurs. Market inception was 2003.

- **Managed:** These transactions are somewhat more complex than other synthetics due to additional portfolio tests, triggers and limitations. The portfolio is selected and managed by a third-party asset manager. The structure is based on rating agency requirements and investor demand. In older deals, risk was generally fully distributed, but since 2004 most deals have hedged part of the risk on financial intermediaries' balance sheets. Market inception was 1997, but volume grew significantly in 2000.

- **CDO-squared:** CDO-squared or CDO-of-CDOs are probably the most complex transactions in the structured credit market. They are effectively a synthetic CDO tranche referencing other CDO tranches. Subordination in "inner CDOs" protects against initial corporate credit events, and subordination in the "master CDO" protects against credit events in the inner CDOs to a threshold, beyond which losses accumulate quickly. There has been huge growth in the last year due to tight spreads in other credit markets.

- **EDS:** Equity default swaps may be used as collateral for CDOs, but only a few deals have referenced EDS exclusively. More often, there is a 10 – 15% bucket for EDS in a CDO that mostly references CDS (although many investors have been wary of even including a bucket this size).

The cash market is composed of several types of transactions. Most outstanding deals are "Cashflow" CDOs, where cash flows sequentially through the interest and principal waterfall to equity unless certain triggers are violated. These triggers deteriorate only when the par value of collateral decreases due to

defaults or trading losses (i.e., cash flows are largely independent of collateral market value fluctuations).

- **Cashflow HY CLOs:** Collateral is typically BB/B leveraged loans (8x – 12x levered). Market inception was 1996 with steady growth since (35% of outstanding issuance).
- **Cashflow SF CDOs:** Collateral is usually either AAA/AA ABS (100x levered) or BBB ABS (20x levered). Current deals have high home equity loan exposure. Market inception was 1998 with rapid growth in 2003 – 2004 (27% of outstanding issuance).
- **Cashflow HY CBOs:** Collateral is typically BB/B high yield bonds (8x – 12x levered). Market inception was 1990 with little issuance after 2001 due to problems in older deals (14% of outstanding issuance).
- **Cashflow Other:** Collateral may include emerging markets, trust preferred securities, municipals, project finance or other assets (5% of outstanding issuance.)

The remaining deals are "Market Value" CDOs, where de-leveraging can be triggered by market value changes. Collateral sometimes includes hedge funds and private equity, which must be liquidated to make coupon payments (3x – 5x levered). Collateral may also include liquid securities. Interest in these deals has increased in 2005 (5% of outstanding issuance).

2. Forces Driving Market Activity (both cash and synthetic)

(a) Balance sheet

Early "Balance Sheet" CDOs were initiated by holders of securitizable assets, such as commercial banks, which desired to sell assets or transfer the risk of assets. The motivation of these deals was typically to shrink the balance sheet, or reduce required regulatory or economic capital. Today, fewer Balance Sheet CDOs exist, although they are still common in Asia.

(b) Arbitrage

The motivation for most CDOs is arbitrage. These deals are inspired by asset managers, dealers and equity tranche investors, who use the CDO

structure to fund collateral purchases. Asset managers gain stable management fees, grow assets under management and often achieve upside through incentive fees and retained equity risk. Financial intermediaries gain underwriting fees. Equity tranche investors hope to achieve a leveraged return between the yield on the assets and the financing cost of the debt. This potential spread is the "arbitrage" of the arbitrage CDO.

(c) Spread pick up

For rated debt investors, the key motivation is a spread pick-up versus like-rated investments in the corporate or ABS market. In addition, CDOs are a means to customize exposures that cannot be achieved any other way, gain access to a diversified pool of assets and gain access to markets such as leveraged loans.

3. Long and Short Users

Cash CDOs are sold to institutional investors and are registered as 144A or RegS securities. Cash CDOs are overwhelmingly a long-only market. Shorts are more common in the synthetic space, although approximately 75% that market is still long only. Approximately 70% of cash transactions are originated out of the United States with US assets, although the investor base for these transactions is global. Thus far, more synthetic risk is distributed in Europe versus the United States due primarily to MTM issues for US investors.

(a) CDO equity

The arbitrage CDO market originated as a way for CDO equity investors to obtain non-recourse leverage as an alternative to repo financing. CDO equity coupons are targeted to have internal rates of return in the 10 – 20% area, and are seen as an attractive addition to alternative asset allocations, a bucket that may also include private equity and hedge funds. Unlike private equity, CDO equity coupons tend to be front-loaded (later in the deal life defaults or de-leveraging typically cause cashflows to decline). Coupons are sensitive to defaults/recoveries/prepayments, but have limited exposure to market prices.

Insurers and reinsurers (largely buy-and-hold investors located in Europe) were the earliest participants in the CDO equity market and are still large

participants today. More recently, hedge funds and other total return investors have also become involved. Other buyers include pension plans and endowments, who can often avoid mark-to-market requirements that other investors face. Banks are also involved, especially in Asia. Banks often desire CDO equity in the form of combination notes, where equity is combined with another bond from the CDO structure or a treasury strip to achieve a desired rating, principal-protection or some form or regulatory arbitrage. Some CDO equity has been sold to asset managers running CDO equity funds, and to private clients in Europe via brokers and investment consultants. The fact that asset mangers often hold 20 – 30% of the equity in deals that they manage is seen by many as a positive.

(b) CDO debt

Investors in rated notes desire yield enhancement versus like-rated credits in the ABS or corporate market. In addition, investors are choosing systematic risk over idiosyncratic. For example, strategies such as long mezzanine tranches can decrease event risk by cushioning against initial losses in a pool. Mezzanine investors include hedge funds, banks, insurance companies and asset managers. Long senior strategies provide constant return with catastrophic-only risk. Banks are key investors, as are reinsurers, monolines and insurance companies. Today, most cash senior tranches are sold as part of negative basis trades, where a bank goes long the senior tranche and simultaneously buys protection from a monoline on the same tranche. Older AAA risk often has a monoline guarantee.

CDO-squared have historically been buyers of cash CDO mezzanine tranches, which are then re-securitized into CDO-squared vehicles. More recently synthetic CDO-squared have been creating synthetic mezzanine CDO tranches for inclusion in CDO-squared, or Senior CDO tranches as a 20% bucket in a High Grade SF CDOs.

(c) Short positions

Most short positions are synthetic, as there is no shorting of cash bonds other than with total return swaps, which are limited in use. Synthetic short positions have been increasing, especially in more liquid index trades, but they are still a small portion of the overall market. Shorts may be used by

investors with assets on balance sheet to hedge at a reduced cost versus hedging an entire portfolio (short mezzanine), or to hedge idiosyncratic risk (short equity). However, shorts are more often used by total return investors as part of carry trades (e.g., long equity, short mezzanine), or long correlation trades (e.g., sell equity protection with delta hedges).

4. Risk Management Issues

Participants in the structured credit market are subject to a number of risks, including exposure to market moves, counterparty risk, model risk, valuation and liquidity issues, legal risk and operational risk.

(a) Exposure to market moves

The chart below provides a synopsis of the key risks faced by different structured credit products. A more detailed discussion on related issues follows below.

Chart 7

Risks	Instruments			
	CDS	*Cash CDO*	*Synth CDO*	*CDO-Squared*
Credit Spreads	✓	✓	✓	✓
Recovery Rates	✓	✓	✓	✓
Correction		✓	✓	✓
Overlap (within a single deal)				✓
Serial Dependence				✓
Warehousing		✓		

(i) Credit spreads

A position's sensitivity to credit spreads depends on its seniority in the structure (degree of leverage). Equity tranches or first loss pieces, for example, can be highly sensitive to credit spread moves, as illustrated in Chart 8 below.

(ii) Recovery rates

There are potentially low or zero recoveries on junior tranches, especially if risk is systemic and tranches are thin. The downside to single-name

risk is the recovery rate, and the downside on a tranche is zero. Depending on tranche width, CDO-squared starts to look like being short a digital option.

(iii) Correlation

The value of a tranche within a structure is determined in part by assumptions regarding correlation. The relationship of the tranche value to the correlation assumptions is not always intuitive. As illustrated in Chart 10 below, first loss tranches increase in value under high correlation assumptions while senior tranches decrease in value under such assumptions.

(iv) Overlap

Risk is increased to the extent that a limited investment universe for reference pools leads to high overlap across pools. CDO-squared often have the same names in multiple portfolios. These issues may be exacerbated by the fact that structured credit remains largely long only, which means that investors have similar risk exposure.

Although CDO-squared get the most attention, overlap is an issue for all CDOs. One large financial intermediary has estimated that the overlap between two CLOs from the same manager can be 50 – 70%. CLOs from different managers still have name overlap in the neighborhood of 25%.

(v) Serial dependence

For CDO-squared, risk is serial dependent (i.e., the exact sequence of credit events matters).

(vi) Warehouse risk

The ramp-up period for new cash deals can be over six months, leaving dealers and asset managers exposed to market moves during this period if the deal cannot close. This is less of a risk for synthetics, which can ramp up quickly.

(b) Counterparty risk

(i) Exposure measurement

Properly measuring the exposure of these transactions can be challenging due to, among other things, the large number of underlying risk factors, the non-linearity associated with a potential change in value of positions and the relatedness of reference entities in multi-name structures.

(ii) Risk mitigation

As much of this activity is in derivative form, counterparty risk is usually mitigated by upfront payments for risky tranches, minimum counterparty ratings for more senior tranches and collateral arrangements. Treating collateral consistently with the supporting agreements is yet another challenge for counterparty exposure measurement.

(c) Model risk

(i) Dealer hedging

Dealers run a balanced rather than perfectly hedged book. The entire capital structure is not always distributed and residual risk (delta, gamma, recovery rate, correlation) must be hedged.

(ii) Ratings arbitrage

Many CDO investors buy tranches based on ratings, with the implied assumption that CDO performance should at least approximate other like-rated fixed income securities. To the extent that CDO defaults or recoveries are worse than the rating indicates, investors may have more risk than they realize (some CDO sectors have clearly performed worse than single-name CDS with equivalent rating/risk). Other investors buy CDO tranches as a form of ratings arbitrage, which could lead to less required economic and regulatory capital than would otherwise be the case.

(d) Valuation and liquidity

(i) Mark-to-market

Derivatives accounting rules result in high MTM sensitivity for synthetic tranches, which may lead to forced selling in a downturn, especially given a "youthful" market. Europe has been moving more to MTM accounting, and it may be a challenge for banks to buy as this progresses. Although cash CDOs have less MTM sensitivity than synthetics, buyers are not immune to this risk and may also have to sell based on ratings triggers.

(ii) Valuation and liquidity

Valuation for Cash CDOs and managed synthetics is generally market based with daily pricing on Bloomberg for recent large synthetic deals. Market liquidity has improved greatly in the last two years. Cash CLOs and widely distributed managed synthetics are the most liquid, with the best liquidity at the top of the capital structure (largest and easiest to analyze tranches). SF CDOs (complex underlying ABS) and CDO equity (sensitive cash flows) are less liquid.

Valuation for non-managed trades is generally model based, with strongest liquidity for index tranches, including pricing for standardized tranches on Bloomberg. Model risk (valuations, risk represented to investors, hedging) is highly relevant for synthetics. There have been examples where investors/asset managers have experienced serious valuation issues where fraud may have been involved.

(e) Legal risk

(i) Understanding transactions

Recent lawsuits including HSH vs. Barclays and Banca Popolare vs. BofA have sought damages for securities allegedly mis-sold (higher risk than declared), mismanaged (substitutions not in best interest of investors) and misreported (inaccurate price evaluations). Issues of whether investors understand the risk are especially relevant for complex structures such as CDO-squared. Ultimately, these disputes suggest that the intermediaries may have thought that they have sold risk when, in fact, they have not.

(ii) CDS legal risk

As many structured credit transactions involve CDS, they will tend to be exposed to the other legal risk discussed in Section B: Credit Derivatives above.

(f) Operational risk

(i) Confirmations

Faced with the complexity of transactions and technology platforms that are often incompatible, firms can experience delays in confirming transaction details.

(ii) Performance tracking

The complexity of transactions also puts strain on back office operations due to the potential need to track and modify the composition of asset pools, monitor tranche performance and book multiple legs of transactions in the appropriate finance and risk systems.

The charts below illustrate the sensitivities of a sample structured credit position to key input variables.

5. CDX and Tranched CDX Sensitivities

The charts below outline the sensitivity of the CDX and Tranched CDX to spreads, correlation and number of defaults from a long-protection perspective. It is assumed that the long-protection positions were taken on April 6, 2005.

Below is a brief description of the terminology used throughout this section:

- **CDX:** 5 yr CDX .NA.IG.4. Throughout this section, it will also be called "plain-vanilla CDX." As of 04/06/05, the 5yr CDX.NA.IG.4 spread was 47 bps.

- **Tranched CDX:** Synthetic CDO with the same portfolio of reference entities as that defined for the 5yr CDX.NA.IG.4. The collateral is split into tranches, where each tranche bears losses at a different level of subordination. The most junior tranche may experience the first 3% of losses. The next tranche will bear any loss over 3% up to 7%, and so on.

0 – 3%	➔	Equity Tranche or First loss Tranche
3 – 7%	➔	Mezzanine Tranche
7 – 10%		
10 – 15%		
15 – 30%		
30 – 100%	➔	Senior Tranche
0 – 100%	➔	CDX (plain-vanilla CDX)

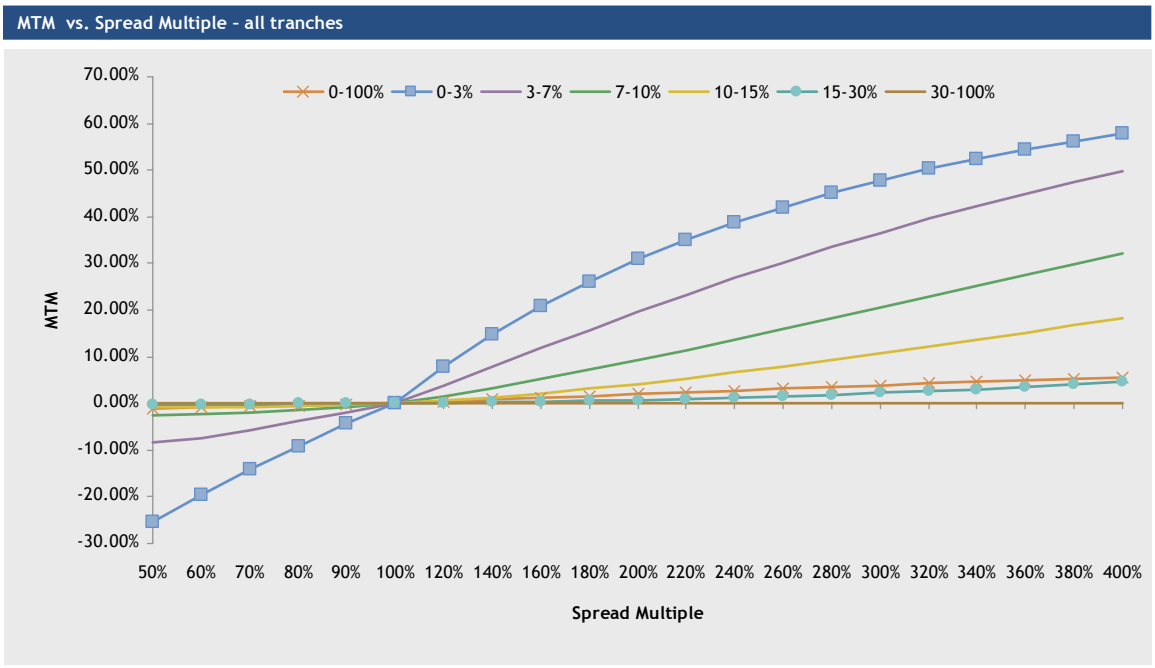
- **MTM:** Expressed as % of tranche notional.
- **Spread Multiple:** Makes reference to multiples of the index spread. 100% refers to the index spread as of 04/06/05 (47bps). 50% refers to a spread of 23.5bps.
- **Correlation:** Refers to the correlation of probabilities of default. It tells us how likely the portfolio is to experience its expected loss.
  - Low Correlation:
    - Defaults occur independently.
    - Most likely outcome is a few number of names defaulting.
    - Expected loss is likely to be reached (as of 04/06/05, the CDX expected loss was 2.43%).
  - High Correlation:
    - Defaults occur in groups.
    - Most likely outcome is many defaults at the same time. In a hypothetical extreme case (correlation = 100%) either 0 names default or 100% of the names default.
    - Expected loss is not likely to be reached.

(a) Chart 8: Sensitivity to Spreads

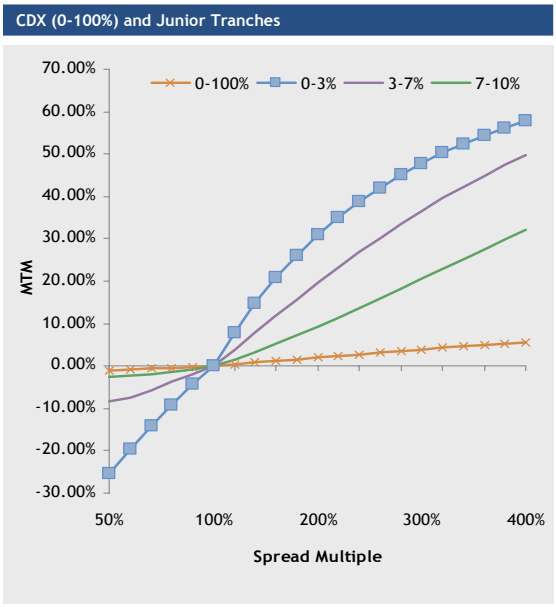
The chart below describes the sensitivity of the CDX (0 – 100%) and the CDX tranches to changes in the CDX Index Spread (in this example, a spread multiple of 100% makes reference to 47bps). The positive slope of both the plain-vanilla CDX and the CDX tranches confirms that a spread widening increases the value of a long protection position. Intuitively, if an investor bought protection and then spreads widen, the value of that trade increases.

The sensitivity is larger in the junior tranches than in both the plain-vanilla CDX and the senior tranches because the most junior tranches (in particular 0 – 3%) are those affected for sure with the first defaults. The likelihood of names defaulting increases as spreads widen.

Chart 8



Note: 0 – 3% assumes no upfront



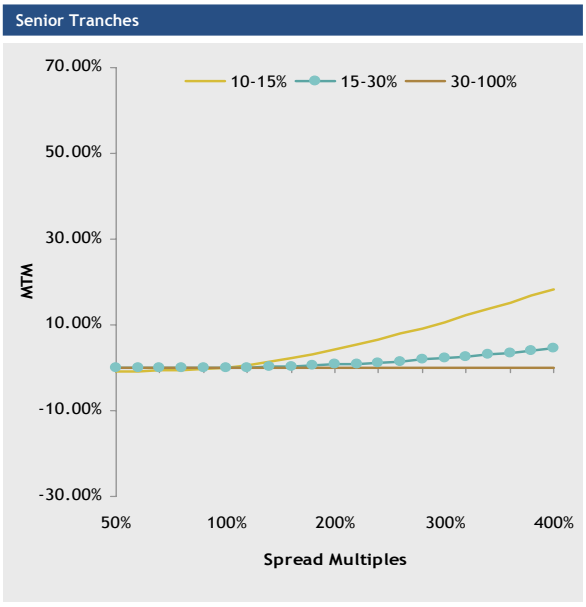


Chart 9 below quantifies the impact that a 100% widening in the index spread (from 47 bps to 94 bps) will have on the MTM of a protection buyer with contracts of $1 million on each tranche.

Chart 9

The MTMs in this table make reference to a Spread Multiple of 200% in the previous graphs (equivalent to an Index Spread of 94bps= 200% x 47bps)

Tranche	MTM	IF the CDX index spread goes up to 94bps AND a protection buyer has a $1mm contract on….
0-100%	2.02%	…the gain will be 2.02% x $1MM = $20K
0-3%	30.84%	… the gain will be 30.84% x $1MM = $308K
3-7%	19.58%	… the gain will be 19.58% x $1MM = $196K
7-10%	9.27%	… the gain will be 9.27% x $1MM = $93K
10-15%	4.22%	… the gain will be 4.22% x $1MM = $42K
15-30%	0.74%	… the gain will be 0.74% x $1MM = $7K
30-100%	0.00%	… the gain will be 0.00% x $1MM = $0K

Were the investor a protection seller, the MTM would be negative, and the investor would report losses equivalent to the gains in the table with the sign inverted.

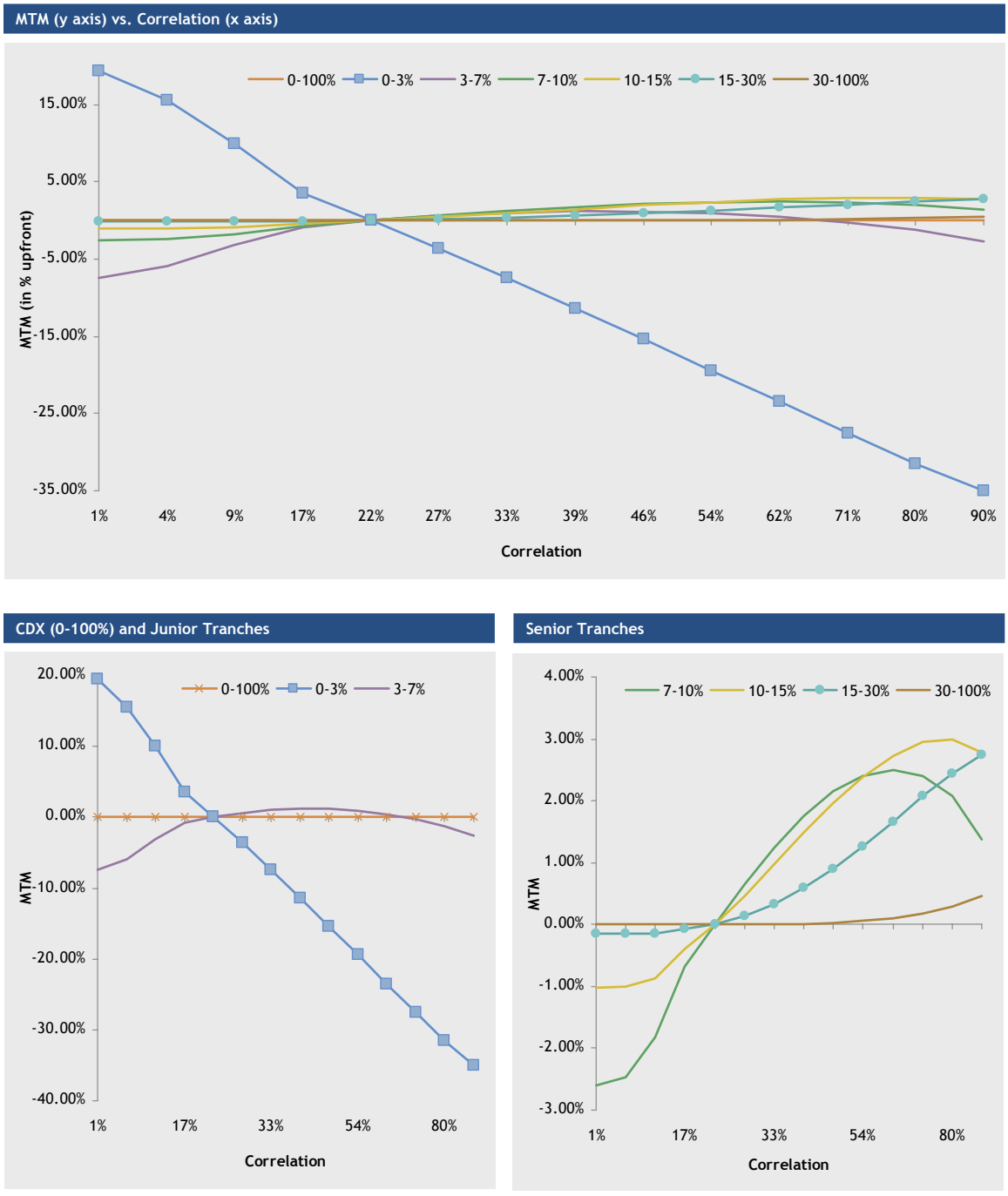
(b) Chart 10: Sensitivity to Correlation

Chart 10 below describes the MTM sensitivity of the CDX (0 – 100%) and the CDX tranches to changes in correlation. Correlation is only relevant to the tranches because the impact of defaults over a specific tranche will depend on the level of tranche subordination. Few defaults (low correlation) will only affect junior tranches whereas many defaults at the same time (high correlation) will impact the more senior tranches as well. The MTM of the plain-vanilla CDX (0 – 100%) is not sensitive to different levels of correlation because any number of defaults (few or many) will affect it anyway.

When correlation is low (extreme hypothetical case: 0%), few defaults are expected and therefore the expected loss (2.43%) is likely to be reached. Being long, the equity tranche (0 – 3%) becomes riskier and as a result being long protection on equity gains value. This explains the negative slope of the first loss tranche.

When correlation is high (extreme hypothetical case: 100%), either 0% or 100% defaults are expected, and therefore the expected loss (2.43%) is not likely to be reached. Being long senior tranches becomes riskier than when correlation was low and therefore being long protection on senior tranches gains value. This explains the positive slope in the non-equity tranches.

Chart 10



(c) Chart 11: Sensitivity to Number of Defaults

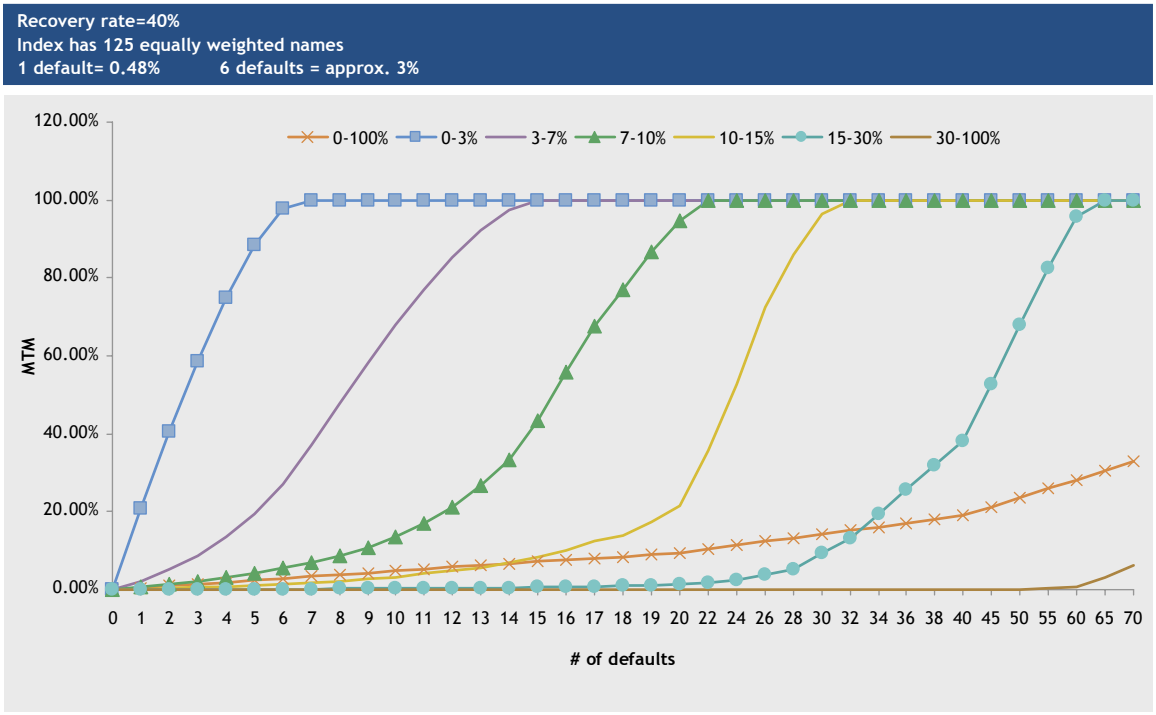
Chart 11 below describes the sensitivity of the CDX (0 – 100%) and the CDX tranches to the number of defaults. The recovery rate assumption used is 40%. Since the index has 125 equally weighted names, one default will generate a loss of 0.48% of the portfolio (1 /125 * 0.6). In the same fashion, six defaults will generate a loss of approximately 3% of the portfolio (6 / 125 * 0.6).

The positive slope of both the plain-vanilla CDX and the CDX tranches confirms that defaults increase the value of a long-protection position. Intuitively, if an investor bought protection and then credits default, the value of that trade increases.

Notice that each tranche reaches 100% of its notional at the number of defaults that produce a loss equivalent to the upper bound of the tranche. For instance, the equity tranche reaches a MTM of 100% at six defaults, which is equivalent to a loss of 3% of the portfolio. Also notice that the slope of each non-equity tranche becomes steeper exactly at the max level of defaults that the immediate junior tranche can bare. For example the 3 – 7% tranche becomes steeper at six defaults.

Defaults impact each tranche very differently. The impact over the plain-vanilla CDX is linear because the index is equally weighted. The impact over the 0 – 3% tranche is the largest (the curve is the steepest) because all the burden of the first defaults will only impact this tranche.

Chart 11


Recovery rate=40%
Index has 125 equally weighted names
1 default= 0.48%
6 defaults = approx. 3%
0-100%
0-3%
3-7%
7-10%
10-15%
15-30%
30-100%
120.00%
100.00%
80.00%
60.00%
40.00%
20.00%
0.00%
MTM
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 22 24 26 28 30 32 34 36 38 40 45 50 55 60 65 70
# of defaults

D. Equity Derivatives

This section looks at some of the more recent developments in the Equity Derivatives market that have, or have the potential to have, embedded leverage. We highlight three types of instruments that have grown rapidly during the last five years, fuelled in part by a demand for yield from a broad range of investors, including retail and institutional investors as well as hedge funds.

One key theme is that investor demand for specific derivative products can create an imbalance of longs and shorts, giving many derivatives providers similar risk exposures. To the extent that risk providers (investment banks) are unable to repackage risk into other products or markets, aggregate risk — for example, to correlation, dividend growth or gapping risk to a new asset class such as hedge funds — can grow rapidly.

Derivatives based on hedge funds themselves have also seen increased demand from institutional and retail investors. Successful hedging of these products can mean leveraged exposure to funds which are themselves leveraged. Furthermore, hedging option based products on hedge funds critically depends on the funds providing continuous investment access for hedging and low volatility in returns without gapping.

1. Instrument Description and Market Developments

Demand for derivatives has continued to grow strongly over the last five years, fuelled by the growth of leveraged investors such as hedge funds, increased demand (and understanding) from traditional asset managers, increased demand from retail investors and increased activity by corporates.

On the supply side, the ability of intermediaries to price, hedge and warehouse risk has grown accordingly. Banks have also moved to consolidate their management of hybrid desks to improve their cross asset-class pricing and risk-management abilities.

Below we highlight product development in three areas that have shown particular growth in the last few years — synthetic investments, hedge-fund based products and volatility and correlation swaps.

(a) Synthetic investments

Includes Structured Products, e.g., EMTNs, Certificates, Warrants, Managed Fund based products and OTC derivatives.

Synthetic investments have continued to gain market share, with developments in underlying securities, payoff functions and a broadening of the user base. For example, private banks, regional banks and retail brokerages regularly sell structured products to retail investors. Developments in modeling and pricing give originators a broader offering of payoffs on a broader array of underlying instruments, spanning multiple asset-classes, including open-end investment funds and hedge funds.

Synthetic investments may or may not be risky instruments for the end-user. For example, many offer some form of capital protection or lock-in features which give the investor less downside risk. The flip side of course is that issuing institutions have the opposite risk to manage, usually on a mark-to-market basis.

The Target Annual Review Note is representative of a class of products which have been very popular with investors and which many banks have issued over the last few years.

- **Example of a Target Annual Review Note on a Basket of Stocks (e.g., 5 blue-chips)**
  - *Invest 100 today.*
  - *Capital is 100% protected. The investor receives at least 100 at maturity/redemption.*
  - *10 year maturity, subject to early redemption if total coupon payments reach a pre-determined target (e.g., 25%). Redemption amount is capital plus target.*
  - *Annual coupon based on return of the worst performing stock in the basket (floored at 0%).*
  - *Early redemption if the sum of all coupons should reach the target (e.g., 25%).*

Note that early redemption can be good for the investor, who then receives the target return early. If stocks in the basket are uncorrelated, there is more likely to be a stock that performs poorly and therefore for the coupon to be low. In this sense, investors are long correlation, and issuing banks are short stock correlation. Similarly, investors are short volatility, and issuing banks are long volatility.

Early redemption also contributes to embedded leverage. If the underlying stocks rally, not only does the coupon increase, but early redemption becomes more likely. As the sum of the coupons approach the target, it is possible for the delta equivalent positions in individual elements of the basket to exceed 100% of the notional value of the note. This occurs due to the fact that the price return of any element not only drives the coupon return of the note, but due to the varying redemption, will also drive the maturity of the note. The combined impact can be quite high with the result that the cash equivalent sensitivity in the underlying basked element can be large.

The charts at the end of this section illustrate the sensitivity of the TARN product to key input variables.

(b) Hedge-fund based products — Constant Proportion Portfolio Insurance (CPPI), option-based and leveraged exposure

There has been strong demand for products that provide access to hedge funds that are principal protected and leveraged. Several examples of these are the TARN structure and Constant Proportion Portfolio Insurance (CPPI) products.

- **Example of TARN on Fund of Hedge Funds**
  - *Invest 100 today.*
  - *Capital is 100% protected. The investor receives at least 100 at maturity/redemption.*
  - *Maximum maturity of 10 years, subject to early redemption.*
  - *Regular income through annual coupons.*
  - *Coupon size is linked to the performance of a Fund of Hedge Funds.*
  - *Early redemption if the sum of all coupons should reach the target (e.g., 20%).*

- **Constant Proportion Portfolio Insurance (CPPI) on Hedge Funds**

  Although CPPI-based strategies have been well known for many years, one area of growth has been in CPPI-based strategies which use new assets including hedge funds as the underlying risky asset. Such investments are popular in the retail market either as an investment fund or as a structured product, with gap risk underwritten by a bank or insurers, or repackaged and sold as yield enhancement products. CPPI allows for leveraged investment in a risky asset, typically capped at 200%.

  - *The CPPI strategy varies the amount invested in a risky asset (e.g., equities), depending on its performance. The strategy increases the risky investment when the asset gains value and decreases the risky investment when the asset loses value. Monies not invested in the risky asset are typically invested in low-risk instruments such as government bonds.*
  - *CPPI-based strategies seek to preserve a minimum return by switching more and more investment into the low-risk asset if the risky asset loses value. This strategy means that risky assets are bought after a rally and sold after a sell-off, a classic option replication strategy; buying high and selling low is the price paid for an option-like return of limited downside and unlimited upside. Gap risk is incurred.*

The derivatives market has helped to grow and develop the demand for such investments by packaging them into synthetic products which give the payoff of a CPPI strategy and allow a risky asset to be leveraged above 100% if it increases enough in value. As with many synthetic investments, additional features such as lock-ins and guaranteed minimum exposures are common, together with the inclusion of (hedge) funds as underlying assets.

(c) Variance and correlation swaps

A variance swap is an OTC derivative with a pay-out dependent on the variance of returns of an underlying asset such as an equity or equity index. Variance is the square of volatility. Variance swaps allow investors to buy or sell volatility, almost as an asset in its own right. Leverage is limited only by internal or counterparty risk limits.

The variance swap market has grown enormously in the last five years, initially based on equity indices and, over the last few years, on single equities. In turn, this allows investors to trade the spread between index and single stock return variance, a spread which is a closely related to the correlation of stock returns. This has spurred the growth of the correlation swap market, which allows investors to directly go long or short the correlation of equity returns.

Growth in the variance and correlation swap market has been driven in part by investor demand to trade volatility and correlation in a direct manner as a diversifying asset class. However, leveraged investors such as hedge funds have been the main users as they seek to capitalize on market mispricings which have themselves been driven by imbalances in the supply and demand of other derivative products. As such, variance and correlation swaps are a useful way for banks to re-package risk to investors, although as discussed below, selling risk on to other players does not necessarily diminish the overall risk in the marketplace.

(d) Market size

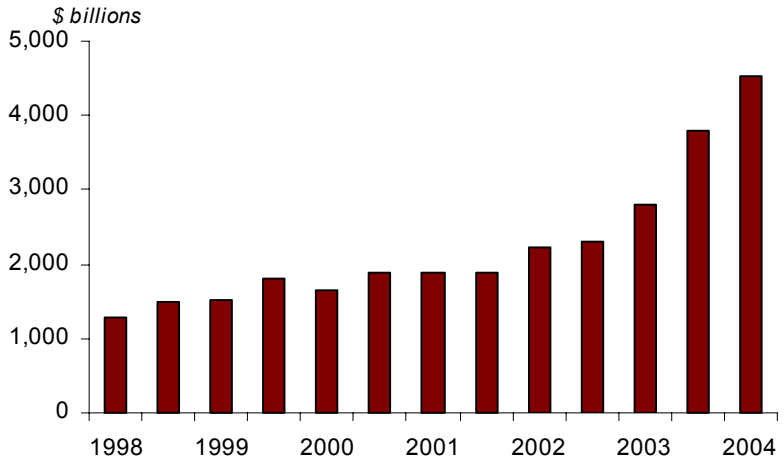
Equity derivatives trade in the OTC market, the listed market and in the structured product market (notes, certificates, etc.). All markets have seen strong growth in the last five years.

In the OTC market, the notional outstanding of equity-linked derivatives was $4.5 trillion as at June 2004, having tripled in size over the previously five years (source: BIS).

The listed options market has also shown strong growth. For example, in 2004 the combined open interest of equity index options contracts on was around $3 trillion notional, double that of 1999. Turnover, at $200 billion notional per day in 2004, was triple that of 1999 (source: BIS).

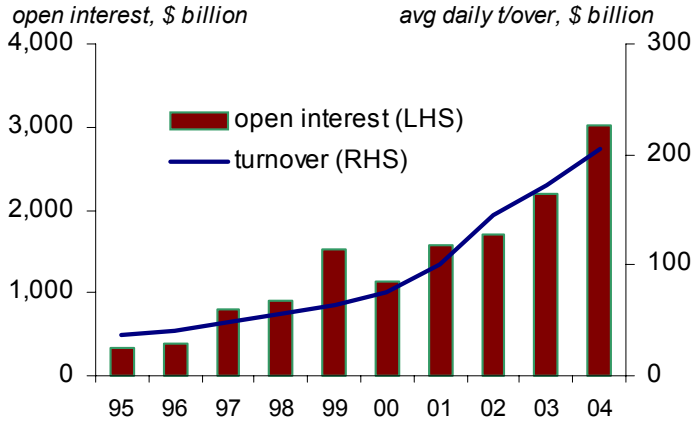
Data for the retail structured product markets is less comprehensive. Estimated issuance in Europe was around €100 billion in 2004. Around half of the issuance was in Italy, Spain and the UK (the other major European markets are France, Germany and Switzerland). On this basis, the market has doubled in size since 2000 (Chart 14).

Chart 12
Amount outstanding of OTC equity-linked derivatives



Source: Bank for International Settlements

Chart 13
Listed index option open interest and turnover



Source: Bank for International Settlements

Chart 14
Retail structured product issuance volumes, € millions

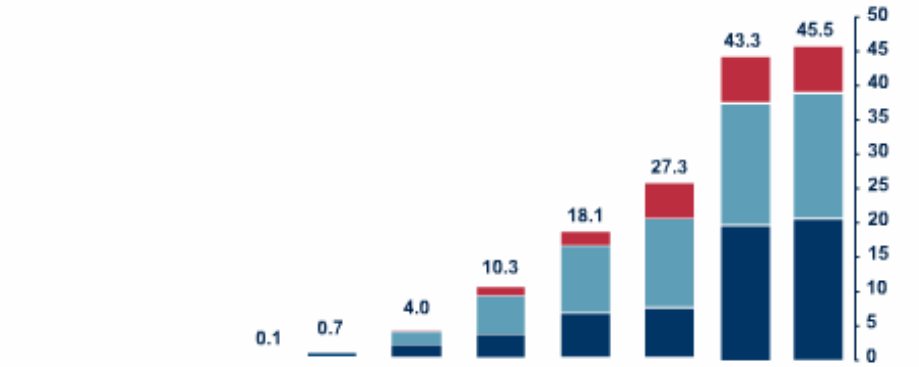
	Italy	Spain	UK	Total
2000	15,700	7,300	2,500	25,400
2001	15,200	9,000	5,500	29,700
2002	23,500	13,600	6,300	43,400
2003	23,100	20,100	5,600	48,800
2004	25,800	19,300	6,100	51,200

Source: Arete consulting (retailstructuredproducts.com)

Hedge funds have grown enormously over the last few years, and reflecting this growth the derivatives market has witnessed much demand for hedge-fund linked products. Hedge fund assets under management were estimated at $973 billion at the end of 2004, having doubled during the previous five years (HFR Year-End 2004 Industry Report).

There is little data on the size of the hedge fund derivative market. Anecdotal evidence suggests strong growth over the last five years. For example Lyxor, the fund-management arm of the Societe Generale Group and one of the largest providers of structured investments, has seen retail assets under structured management (which we take to be hedge-fund based structured investments) grew ten fold in the last five years, from €2 billion in 2000 to €20 billion in 2004 (see Chart 15 below).

Chart 15
Lyxor AM assets under management (€ billion)



	1998	1999	2000	2001	2002	2003	2004	2005
Index Tracking			0.2	1.2	2.1	3.5	6.6	6.7
Structured Funds	0.1	0.5	1.9	5.6	9.7	13.2	17.2	18
Structured Alternative Investments		0.2	1.9	3.5	6.3	10.6	19.5	20.8

Source: retail.lyxor.com

The variance and correlation swap market is largely OTC-based. One large dealer estimates turnover in Europe, measured in options notional equivalent, to be around €20 billion per year.

2. Forces Driving Market Activity

Derivatives can offer payoffs and risk-return profiles that are difficult for an investor to achieve with the underlying instruments alone. Also, they can provide easy access to less liquid or less accessible investments such as hedge funds.

In addition, exposure to derivatives can diversify investor returns via their exposure to volatility or correlation.

The growth of the specific products highlighted above has been driven by some of the classic drivers of derivative product development. Yield enhancement has driven development of synthetic investments. Correlation and variance swap markets developed not only due to demand from hedge funds to trade these "asset classes," but also because they allow investment banks to recycle the risks implicit in synthetic investments. Demand for access to new asset classes has fuelled demand for hedge-fund linked products.

(a) Yield enhancement

The search for yield and an increased focus on absolute returns means that investors have been attracted to yield-enhancing derivative products. Yield enhancement includes basic strategies such as covered-call writing, as well as structured investments such as TARN notes discussed above.

TARN type products leave risk providers long single stock volatility and short correlation. Liquidity constraints can mean that stock volatility is hedged with short index volatility, again creating short correlation exposure.

(b) Recycling risk

Financial intermediaries' risk books accumulate risk positions through structured products (for example, long volatility and short correlation). Clearly banks do not have unlimited appetite for such risk so it is repackaged in various ways. Among the most popular are variance and correlation swaps which are traded with hedge funds and proprietary trading desks in order to mitigate exposures. There also is a significant amount of cross or proxy hedging which gives rise to basis risks.

(c) Access products

The growth in hedge fund linked derivatives has been largely fueled by investor demand to have access to hedge fund exposure, and derivatives provide a useful access vehicle to as well as being able to offer features such as capital protection. Structured investments provide easy access and an ability to diversify returns.

In addition to the development of specific products, the equity derivatives marketplace in general continues to grow strongly, as detailed above. Attractions include leverage, diversification and enhancement of returns, tax efficiency and the ability to structure required exposure with precision. Furthermore, capital protected products are attractive for investors who wish to switch back into equities in a cautious way. Finally, derivatives continue to generate attractive margins for financial intermediaries — and these returns may appear to exceed the margins of conventional products such as mutual funds or secondary market securities commissions.

3. Long and Short Users

Demand for synthetic investments comes from institutional and retail investors. Private banks, brokerages and financial advisors, savings banks and other retail orientated financial institutions are selling these products aggressively as the margins are good and end client appetite seems to be large. Supply comes from investment banks' structured product desks, dependant as ever on their ability to price and manage risk.

Demand for hedge fund linked products again comes from retail and institutional investors. Investment banks will hedge exposures by dynamic investment in the underlying funds.

Investment banks buy stock volatility and sell correlation through synthetic investments, and this risk is partially recycled within the professional market through vehicles such as options and variance and correlation swaps. Counterparties include hedge funds, investment banks and proprietary trading desks. There are some products that allow investment banks to sell volatility to real-money investors though they tend to be index based.

4. Risk Management Issues

(a) Suitability

Embedded leverage is a characteristic common to many derivative products. The examples discussed above are relatively new products in the equity derivative markets and, as such, they offer investors unique opportunities but may pose new and complex risks to providers.

As discussed, for end-users, some of the incentives to purchase these products are:

- The opportunity to obtain premium yields on principal protected debt in a low yield environment; and
- Obtaining access to hedge fund returns with principal protection.

Premium yields, however, are obtained through the sale of options embedded in the coupon structure of debt. In this case the debt investor (which has expanded to include retail) has now become an option writer with the contingent liabilities associated with short option positions. For providers of this product, this creates the obligation of assuring the products are suitable for these investors and that they are provided with adequate disclosure.

(b) Dividends

Risks vary from the extremely simple "delta one" to the very complex. One common feature is that many products are long the price return (as opposed to total return) of an underlying equity or equity index. Dividends are a key determinant of pricing forward contracts in equities, and hedging exposure to changes in dividends is sometimes difficult to obtain. Some of this risk is managed by trading forwards and dividend swaps with other banks and hedge funds, although aggregate market risk is not reduced. Changes in accounting regulations or tax rules that systematically reduced company dividends would therefore impact the market.

(c) Correlation

As described above, many of the popular synthetic products are long correlation for the investor. Again, banks buy correlation back from each other and from hedge funds. Systemically, however, the professional community is short. This is compounded by hedging long stock vega with short index positions. The risk is that correlation trends upwards due to demand/supply and/or enforced liquidation. In addition, crashes are generally highly correlated events.

(d) Hedging

Hedge funds tend to follow similar opportunities (*Have Hedge Funds Eroded Market Opportunities*, JPMorgan, October 2004). We have seen in the past (e.g., LTCM) that hitherto uncorrelated positions suddenly become very much related when the marginal cost of risk capital suddenly widens. Hence, for derivative providers, underlying assets (hedge funds) may be prone to gaps and correlated gaps at that. In addition, the ability of synthetic product providers to hedge is limited to daily at best, and monthly or quarterly is more common. This time delay in executing hedges in hedge funds may impair the effectiveness of the hedging strategy for option based products — and compounds the sensitivity to gapping in price returns.

As mentioned above, some of the risks associated with synthetic products on hedge funds are sometimes laid off with hedge funds. This creates a question as to the effectiveness of the hedging trade should there be a systemic issue with the hedge fund industry. For example, can the provider of synthetic products rely upon insurance purchased on hedge fund gapping returns if the insurance was purchased from a hedge fund?

Variance swaps have existed for a while but their usage has increased a great deal over the last five years, and they are now being traded on single stocks and other products. One risk management problem that can occur is analogous to the problem of outperformance options where a stock price appears in the denominator. Statistically, it is impossible for a stock to go to zero (in a conventional log-normal world) but in reality it is quite possible. In some jurisdictions, quasi-bust stocks can keep trading for a very long time. In these circumstances the stock volatility can be immense (and open to manipulation). One approach to this problem is to place far out-of-the-money caps on a variance swap payoff so such an outcome would be expensive but not crippling for the variance swap payer (the short).

While the returns of these products to providers can be high, the risk management challenges are non-trivial as some key risks are not easily recycled in the dealer community:

- Short correlation in equity due to systematic sale of index options as hedges of long single stock options;

- Long dividend risk on stocks due to the long term forward risk arising from synthetic structures;
- Structural sensitivity to gapping risk in hedge fund price returns; and
- Impairment of hedging strategies in hedge fund linked structured product due to the constraints on the purchase and sale of hedge fund shares.

The emergence of such structural risks is common to the creation of new financial products. It is important that they be recognized, measured and controlled. Furthermore, profitability of the products must be assessed with regards to the risk capital required to support the concurrent risks as they may exist over the term to maturity of the deals. Lastly, as a catalyst to product evolution, there must be a continued and focused effort on developing a recurring liquid market for recycling these risks.

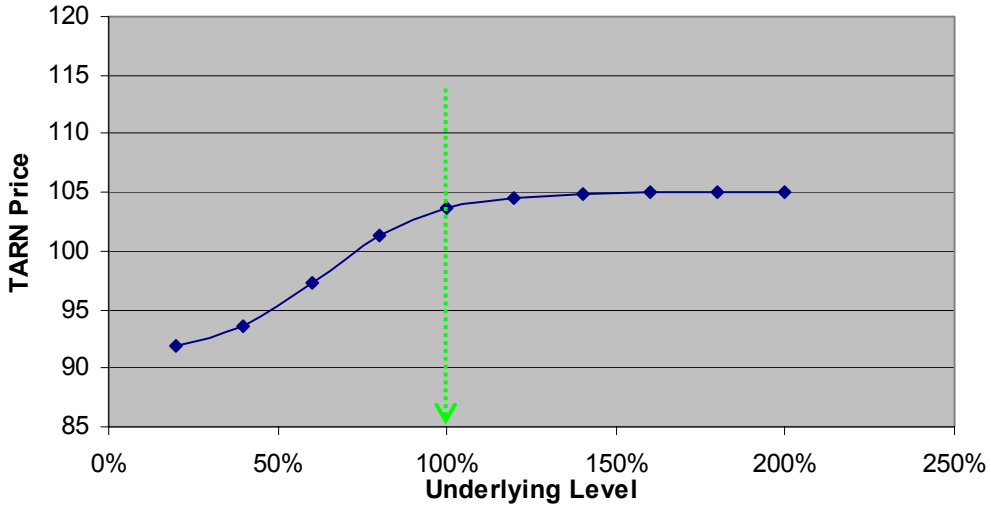
5. Price Sensitivity of TARN to Input Variables

- Instrument: 100% Capital Protected Target Redemption Note.
- Initial Coupon in Year 1 = 10%.
- Coupon Years 2 through 10 = Max[((minimum return of any one of five reference assets) + 15%), 0], where the return is computed from the initial issuance date to the coupon payment date.
- Maturity: Redeems in 10 years or earlier if the sum of all coupon payments reach a target level of 25%.
- Interest rates: 2%.
- Implied volatilities: 20% (no skew) for all underlyings, except in Chart 17 where Underlying 1 is assumed to have a 5% implied volatility.

(a) Chart 16

Chart of the TARN price versus the value of the basket of the five reference assets (assuming all assets move together).

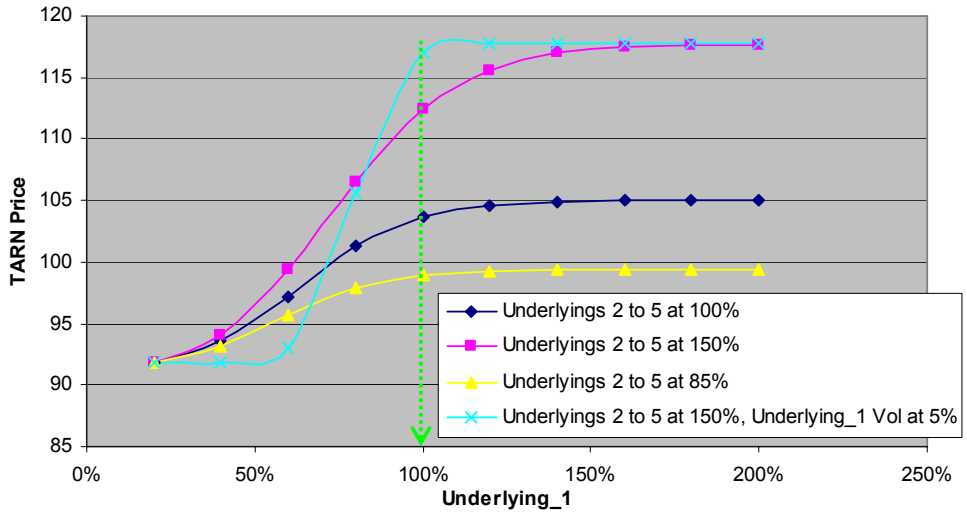
Chart 16
TARN Price vs. Underlying Level



(b) Chart 17

Chart of the TARN price versus the level of one of the five underlying assets while the other four are held static at their initial value (100%), higher value (150% of initial) and lower value (85% of initial). Note that the rate of change in the TARN value differs depending on the level of the other assets and the volatility of the single asset.

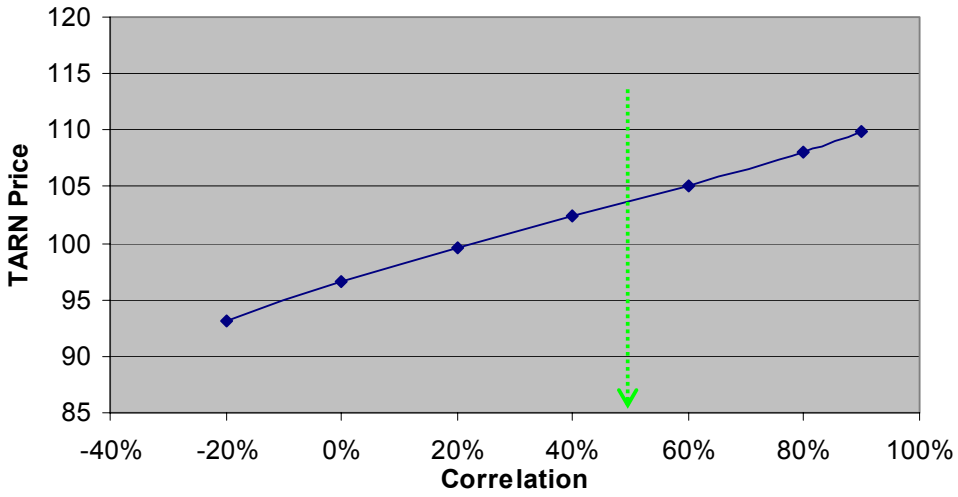
Chart 17
TARN Price vs. Underlying_1



(c) Chart 18

Chart of the TARN price versus the basket average correlation (assuming all pair-wise correlations move together). The buyer of a TARN is long correlation. As the correlation increases, the underlyings move closely together and there is less chance of any one stock lagging behind and extending the life of the trade. On the other hand, lower correlation will result in a more dispersed distribution of the underlying returns and there is more likelihood that the worst performer is substantially below the initial level.

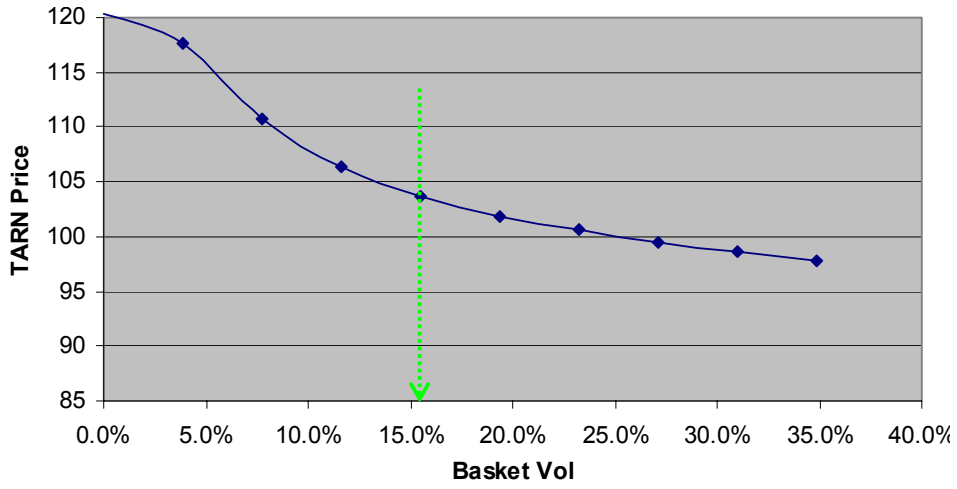
Chart 18
TARN Price vs. Correction



(d) Chart 19

Chart of the TARN price versus the basket volatility (assuming all underlying assets volatilities move together). As the volatilities go to zero, the coupon is guaranteed to hit the target (all the underlyings are above the 85% strike), and the price converges to the present value of the initial coupon in Year 1 plus the target coupon and notional at Year 2. As the volatilities go up, the price decreases as the probability of at least one underlying having a large negative move increases.

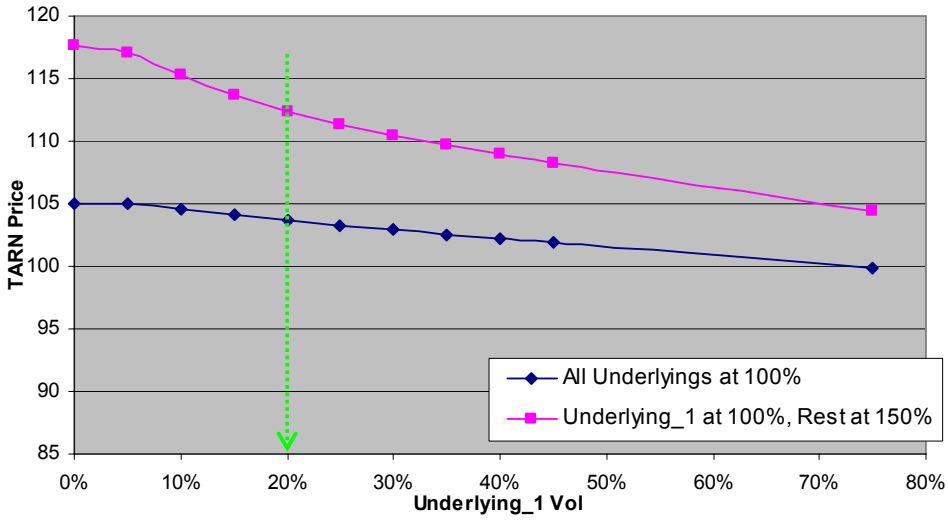
Chart 19
TARN Price vs. Basket Vol



(e) Chart 20

Chart of the TARN price versus the volume of one of the five underlying assets. The buyer of the TARN is short volatility to each of the underlyings at inception. Increased volatility increases the chances of the worst performer having a large negative move and hence increasing the life of the trade. Note that the sensitivity to the volume of one underlying depends on the level of the other underlyings. For example, if all the other underlyings are well above the strike, then the TARN price will be more sensitive to the volume level of the worst performer, as shown in the chart.

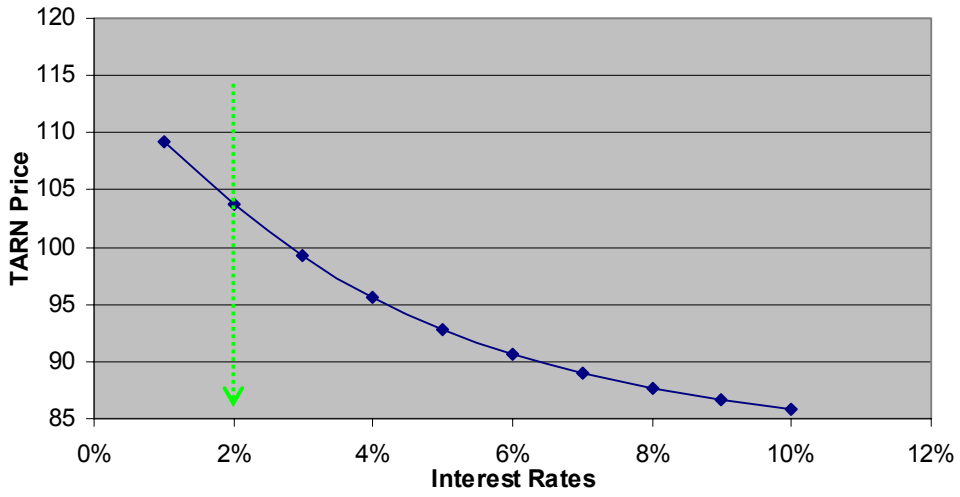
Chart 20
TARN Price vs. Underlying Vol



(f) Chart 21

Chart of the TARN price versus interest rates. The buyer of the TARN is long interest rates. As the interest rates increase, the present value of the coupons plus the notional due at maturity decreases, reducing the price of the structure.

Chart 21
TARN Price vs. Interest Rate



(g) Chart 22

Chart of the TARN price versus the dividend yield of one underlying. The buyer of the TARN structure is short dividend sensitivity, but the magnitude of this sensitivity is relatively small. As the dividend increases, it has the effect of reducing the forward of the given underlying, and this has the effect of increasing the effective life of the TARN (chances of paying an early coupon are reduced). Note that the sensitivity to the dividends of one underlying depends on the level of the other underlyings. For example, if all the other underlyings are well above the strike, then the TARN Price will be more sensitive to the dividend level of the worst performer, as shown in the chart.

Chart 22
TARN Price vs. Underlying_1 Div