

Hedge Fund Derivative-Linked Products
Current Market Practice, Risk Management & Capital Treatment

OPSRA – Cross Firm Project

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EXECUTIVE SUMMARY

Introduction

Hedge fund derivative-linked products, also referred to as structured hedge fund products, are derivative instruments where the reference assets are hedge fund shares, fund of hedge fund (“FoF”) shares, or hedge fund indexes. The dominant structured products at CSE firms are Constant Proportion Portfolio Insurance (“CPPI”) instruments that offer leveraged returns tied to hedge fund performance as well as protection of principal.¹ For CPPI instruments, Issuers allocate investment proceeds between risk-free assets (e.g., zero coupon bonds) and risky hedge fund shares. The proportion allocated to hedge fund shares is determined by an allocation formula, and varies over time depending on the performance of the hedge fund. Better hedge fund performance results in a larger proportion of the investment being allocated to risky hedge fund shares and less to risk-free assets. Conversely, poor hedge fund performance results in a lower proportion of the investment proceeds being allocated to the risky asset and a higher proportion allocated to risk-free assets. This allocation to risk-free assets during times of poor fund performance provides the principal protection for investors.

CSE firms also issue Total Return Swaps (“TRS”) tied to hedge fund shares.² TRS provide leveraged hedge fund exposure for investors, but do not provide protection of principal. Total return swaps are similar to interest rate swaps in that there are periodic exchanges of cash flows between the issuer and the counterparty. For TRS on hedge fund shares, the exchange of cash flows is tied to the performance of a hedge fund, fund-of-fund, or hedge fund index. The issuer (i.e., the CSE firm) pays the upside and receives the down side related to the performance of a hedge fund referenced asset. The counterparty (e.g. fund-of-fund manager or institutional investor) pays the downside and receives the upside related to the performance of a hedge fund referenced asset. The counterparty also pays a Libor or Fed Funds based floating rate fee to the issuer.

The remainder of the firms’ structured fund portfolios are comprised of products such as Collateralized Fund Obligations (“CFO”), Portable Alpha products, and Pass-through Certificates that are issued by only two of the five CSE firms.³ A CFO is a structured security that, similar to TRS, provides leveraged exposure to the performance of an underlying hedge fund. The structure consists of both a senior “debt” note and a subordinated “equity” note where an investor can gain leveraged exposure to the underlying asset of their choice. Portable Alpha strategies allow investors to generate broad market returns “cheaply” by investing in fixed income or equity indexes, and then combine those returns with above market returns achieved through investments in hedge funds, fund-of-funds, or hedge fund indexes. Pass-through certificates provide a synthetic investment in all of the cash-flows from underlying

¹ As of 12/31/05, CPPI transactions, which can be written as either notes or options, accounted for approximately 71% of the risk and revenue in the firms’ structured hedge fund portfolios. For CPPI notes, the firms invest directly in single hedge fund shares, funds of hedge funds, or indexes on hedge funds. For CPPI options, the firm issues a put option on the hedge fund shares, and then dynamically hedges the risk associated with the option.

² As of 12/31/05, TRS accounted for approximately 8% of the firms’ structured fund portfolios.

³ Lehman Brothers is the only issuer of CFO and Portable Alpha products and Bear Stearns is the only issuer of pass-through certificates. Other products accounted for approximately 21% of the firms’ portfolios as of 12/31/05.

hedge fund indexes or baskets of hedge fund shares. For a fee, the CSE firm pools investor funds together, invests in hedge fund shares, and then passes the cash-flows on to the investors on a pro-rata basis. The specifics of these transactions, as well as the CPPI and TRS transactions, are covered in detail later in this report.

Over a three month period, Office of Prudential Supervision and Risk Analysis (“OPSRA”) staff met with business managers, risk managers, and regulatory controllers to gain an understanding of (1) the various structured hedge fund businesses and products; (2) risks inherent in these products and how those risks are monitored and managed; and (3) the level of capital held against structured fund products as well as the calculation methodology used to derive the capital charge. Additionally, OPSRA staff collected and analyzed data that provides insight into growth trends and product concentrations.

This report begins with a summary of OPSRA’s key findings and is followed by:

- Hedge fund and structured fund trends
- An analysis of structured products at the CSE firms
- Inherent risks and risk management practices
- Capital held and calculation methodologies

Key Findings

Business Overview

Structured fund businesses grew by \$3.6 billion, or 36%, in 2005 to finish the year at \$13.6 billion in total notional for the five CSE firms. All five firms experienced significant growth with Lehman Brothers experiencing the largest growth on a dollar basis, and Goldman Sachs the largest growth on a percentage basis. Across the firms, structured fund businesses grew by 36% from December 31, 2004 to December 31, 2005. Prior to the 2nd quarter of 2005, Bear Stearns had the largest structured fund business among its CSE peers. Significant growth in principal protected notes (“PPN”) and options on hedge funds at Lehman Brothers helped the firm surpass Bear as the largest CSE issuer of hedge fund linked derivative products. Goldman Sachs’ growth was driven by an increase in Constant Proportion Portfolio Insurance

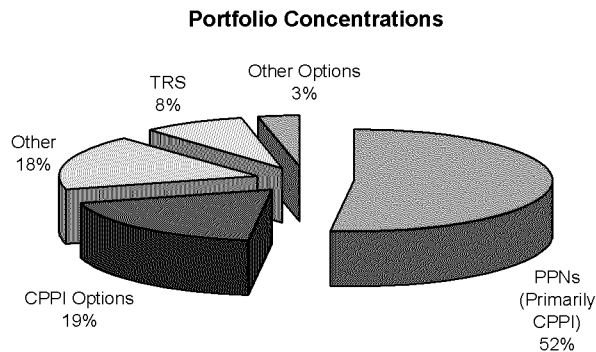
Firm	Total Notional (as of 12/31/05)	Change from 12/31/04	
		(in millions)	(in percent)
Lehman Brothers	5,180	1,277	33%
Bear Stearns	5,033	711	16%
Merrill Lynch	1,628	418	35%
Goldman Sachs	1,554	1,220	365%
Morgan Stanley	230	NA	NA
Total	13,624	3,625	36%

*Merrill Lynch notional is based on the value of the hedge fund underliers

(“CPPI”) products with FoF and single hedge fund underliers. CPPI tied to FoFs grew more than 3 fold in 2005 from \$284 million to \$928 million while CPPI tied to single hedge funds grew more than 12 fold from \$50 million to \$616 million. [See page 8 for additional detail]

Structured funds are dominated by two of the five CSE firms, and are heavily concentrated in CPPI notes and CPPI options. Among CSE firms, Lehman Brothers’ and Bear Stearns’ structured funds businesses are, by far, the largest hedge fund linked businesses

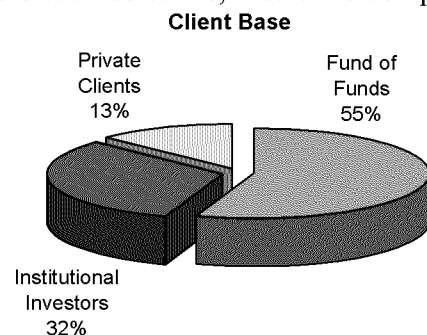
with portfolios of \$5.2 billion and \$5.0 billion notional respectively.⁴ The firms' businesses are active across a wide range of structured fund products such as PPNs (mainly CPPI); options on hedge funds (predominantly CPPI options); and Total Return Swaps ("TRS"). CPPI notes



and options make up approximately 71% of the firms' structured hedge fund linked portfolios while TRS accounts for 8%. The remainder of the portfolio is comprised of other instruments such as American, European, and Asian style options; Collateralized Fund Obligations ("CFO"), portable alpha, pass-through certificates and loans with hedge fund shares held as collateral.⁵

The geographic concentration of the portfolio is 65% issued in Europe and Asia and 35% in the United States. All firms, with the exception of Bear Stearns, are heavily concentrated in Europe. Lehman, for example, issues 79% of their structured fund products in Europe and Asia and only 21% in the United States. Bear Stearns, at the other end of the spectrum, issues 29% of their hedge fund linked products in Europe and 71% in the United States.

Fund-of-funds investment managers are the leading investors in structured fund products, but institutional investors are becoming increasingly important. Structured fund businesses issue products to Fund-of-Fund ("FoF") investment managers, or directly to institutional investors and private high net-worth clients. As of year-end 2005, fund-of-fund investment managers accounted for more than half of the structured product client base; however, CSE firms indicated that institutional investors such as banks, insurance companies, and pension funds are becoming increasingly important as institutions search for higher returns in diversified portfolios. While there are no "typical" client/product combinations, trades with FoF investment managers tend to be larger trades that provide FoF managers with the ability to offer structured share classes, generally either leveraged or principal protected, to multiple investors.



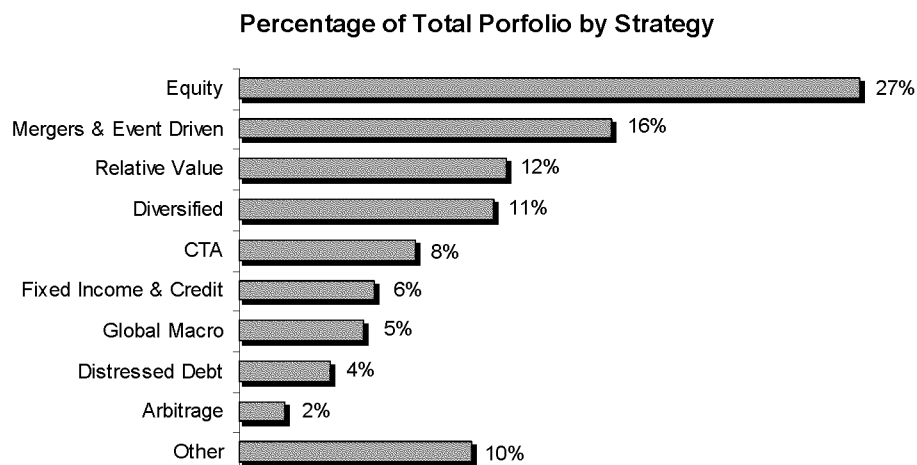
Structured fund businesses issue products tied to FoFs, single hedge funds, or hedge fund indexes. Lehman Brothers, Bear Stearns, and Merrill Lynch are large issuers of structured fund products tied to FoFs while Morgan Stanley and Goldman Sachs issue products tied to single hedge fund shares.⁶ Issuing products with FoF underliers provides diversification that is difficult to achieve with single hedge funds. In general, Lehman, Bear, and Merrill limit their portfolios to FoFs that contain at least 20 hedge funds and employ 3 or more identifiable

⁴ The other three firms, combined, have portfolios totaling \$3.4 billion notional.

⁵ Because our intent was to focus on structured products, we did not delve into the specifics on loans.

⁶ Goldman Sachs issues structured products tied to single hedge funds and FoFs, but products on single hedge funds are growing much faster than those tied to FoFs.

strategies. The three most prominent hedge fund strategies are equity long/short (which comprises 27% of the total), mergers & event driven (comprising 16% of the total), and relative value (comprising 12% of the total).



Risk Management

The primary risk in structured fund products is “gap risk.” Gap risk is the risk that the underlying hedge fund’s Net Asset Value (“NAV”) falls, beyond a pre-specified level (i.e., trigger level or bond floor), faster than a firm can de-leverage out of the risky hedge fund asset. The pre-specified trigger level, or bond floor, is dependent upon the amount of client equity (i.e., equity cushion) available in the transaction. For example, if a structure sets an initial bond floor at 75%, this implies a 25% cushion made possible by client equity. Therefore, the risk to the firm is that the NAV will decline more than 25%, eating through the client’s equity, subsequently exposing the firm to losses. For small movements in NAV, gap risk is minimized by an “allocation mechanism” that reduces the exposure to the risky hedge fund (or FoF) and increases investment in a risk-free asset (either cash or zero coupon bonds). Other risks inherent to structured hedge fund linked products include delta hedging risk; liquidity risk; interest rate risk; counterparty credit risk; operations, legal, and compliance risk. [See “Risk Management” beginning on page 20 for additional detail]

For structured products with FoF underliers, gap risk management contains both qualitative and quantitative nuances. Gap risk is primarily managed at the outset by making sure that (1) each trade conforms to investment guidelines that ensure proper diversification and acceptable liquidity, which allows transactions to withstand multiple fund defaults and significant performance deterioration within any particular investment strategy and (2) that each trade has multiple structural safeguards built into the contract. These structural safeguards include NAV triggers, volatility triggers, annual right to break trades (on most trades), etc. One of the key safeguards that businesses use is to set trigger levels well below the initial level of customer equity in the trade (e.g. a de-leverage trigger at a 3.5% decrease in NAV on a trade containing initial customer equity of 25%). This allows businesses to unwind trades well before customer equity is eaten through. Additionally, while not all firms employ hedges to manage gap risk in structured products, two of the five firms indicated that they have

purchased gap options and macro hedges (e.g., equity puts) after becoming uncomfortable with concentrations in particular fund strategies or sectors. All firms indicated that using VaR as a risk management tool for gap risk is not particularly useful because it does not focus on extreme stress events.

Managing risk in structured funds with single hedge fund underliers requires better visibility and redemption liquidity; or “unique” structure terms. Morgan Stanley, who gets no diversification benefit from writing transactions on single hedge fund shares, requires better visibility into hedge fund assets and better liquidity terms. The firm attains both by only writing transactions on hedge funds with assets held in Morgan’s Prime Broker (“PB”). [See “Liquidity Risk” on page 22 for additional detail] Goldman, who also writes a large amount of structured fund products with single hedge fund underliers, utilizes “unique” structural terms that transfer a majority of the risk to an external PB, and limits the PB’s right to recourse. The risk is transferred through hedge funds, to PBs (external to Goldman), who provide leveraged hedge fund exposure in margin accounts. Limited recourse is contractually agreed upon by the PB at the onset of the structured fund transaction. [See “Goldman Sachs CPPI Transaction” on page 14 for additional detail]

Capital

Capital charges for structured hedge fund linked products are as diverse as the products themselves. When comparing capital held to total notional balance, the two largest CSE firms in this product space—Lehman Brothers and Bear Stearns—hold comparable levels of capital while Merrill Lynch holds a comparatively large amount of capital. Other than a 15%

Firm	Capital Treatment	Notional Balance	Capital Held	Capital / Notional
LEH	Trading	\$5,180	\$132	3%
BS	Trading	\$5,033	\$201	4%
ML	Basel I	\$1,628	\$186	11%
GS	Trading	\$1,554	\$4	0%
MS	Trading	\$230	\$0	0%

operational risk charge on average revenue (which all firms hold), Goldman Sachs and Morgan Stanley hold zero capital. Morgan Stanley’s risk managers indicated that zero capital is just a “place holder” while the firm determines the appropriate way to calculate capital on structured fund products. [See page 26 for additional detail]

VaR produces negligible capital charges for structured hedge fund products. Because VaR does not generally capture extreme tail or stress events (i.e., gap risk), VaR capital charges tend to be negligible. As a result, the three largest players in this product space—Lehman, Bear, and Merrill—apply gap risk add-on charges that account for the vast majority of capital held. Lehman and Bear use internal models to calculate the add-on while Merrill uses a Basel I plus Reg Y add-on approach. [See page 27 for additional detail]

MARKET OVERVIEW

Significant Hedge Fund Trends

To a large extent, the evolution of hedge fund structured products has been a natural extension of the substantial growth experienced in the hedge fund market. Since 1993, Hedge Funds have grown by 17% compound annual growth rate (“CAGR”) from \$168 billion in assets under management in 1993 to more than \$1.1 trillion by year end 2005.⁷ In recent years, hedge fund markets have been characterized by dramatic growth in Europe and Asia, diversity with respect to redemption liquidation periods, increased importance of institutional investors, and shifts in fund strategies. While these changes have led to increased demand for instruments such as structured products creating opportunities for investment banks, they have also created new capital and risk management challenges.

- **Dramatic Growth in Europe and Asia** – In 2001, 85% of hedge fund assets under management were in the United States while only 11% were in Europe and 4% in Asia. Europe and Asia have grown significantly since then to 22% for Europe and 10% for Asia while the US declined to 68%.
- **Redemption Liquidity is Diverse** – Approximately 48% of hedge funds allow monthly redemptions while 38% allow quarterly. Only 2% of Hedge Funds allow weekly redemptions and 5% permit only annual redemptions. Hedge funds in the US tend to be slightly less liquid than funds in Europe and Asia with an overall trend toward less liquidity. While less liquidity is desirable to hedge fund managers, this is in direct conflict with the requests of institutional investors who are pushing for shorter redemption liquidity periods.
- **Institutional Investors are becoming Increasingly Important** – Institutions such as pension funds and insurance companies are increasingly looking to hedge funds for enhanced returns while maintaining diversification. Specifically, institutions are separating market returns (beta) and outperformance of the market (alpha) into two distinct returns where they generate beta returns cheaply (e.g., through diversified index funds or index futures); and look to hedge funds as good generators of alpha. This is because hedge funds provide: (1) more flexible trading strategies; (2) a better track record of generating alpha; and (3) much broader venues for investors searching for alpha.
- **Shift in Strategy Type** – In 2001, more than half (approximately 54%) of the hedge funds utilized an equity strategy, 18% fixed income, and 28% cross assets. In 2005, cross asset strategies were utilized by 46% of hedge funds while equity and fixed income strategies declined to 46% and 8% respectively.
- **New Challenges⁸** – Hedge funds may face hurdles such as capacity challenges, performance challenges, and operational challenges as institutional clients become increasingly important to hedge funds. *Capacity challenges* are being driven by

⁷ Source: *Hedge Fund Review (HFR) Q4 2005 Industry Report*, Tass, Lehman

⁸ Source: *Eric Vezie, Lehman Fund Derivatives meeting, February 24, 2006.*

substantial institutional capital inflow resulting in rapid growth in hedge fund assets. A hedge fund with rapidly growing assets runs the risk of becoming inflexible with respect to the size and the number of trades it can successfully transact in without negatively impacting markets. The influx of institutional investor capital has also resulted in *performance challenges* as the additional capital leads to certain strategies becoming “crowded” and perceived arbitrage potential going away. In this situation, many hedge funds may look to exit the strategy at the same time. Institutional investors also create *operational challenges* for hedge funds as institutional clients demand not only disciplined, repeatable investment processes, but also business management skills that are new to the industry (i.e., technology compliance and human resource management).

Trends in Hedge Fund Derivatives/Structured Products

As hedge funds have grown, there has been an increase in client demand for specially structured hedge fund products through third party distributors (i.e., investment banks). Demand for hedge fund linked structured products from third party distributors is a phenomenon that began in 1998.⁹ Credit Swiss First Boston (“CSFB”) and Societe Generale (“SG”) were the first institutions to offer these products. CSFB offered an in-house fund on hedge funds while SG offered principal protection on fund of hedge funds.

Demand for hedge fund structured products has increased significantly as many institutional investors have found that returns on traditional asset classes have become less attractive compared to hedge fund structured transactions. A majority of structured products sold to date have either been CPPI notes (where the issuer invests directly in hedge fund shares) or synthetic CPPI options where the structure gains hedge fund exposure through an option on a hedge fund underlier. One of the CSE firms estimates that the leading dealers in hedge fund derivative products are SG, BNP Paribas, UBS, and CSFB; and that in aggregate, 2004 structured hedge fund revenues for these firms amounted to approximately \$1 billion.

Similar to the overall hedge fund market, hedge fund derivative products have displayed some interesting trends in recent years. An annual study by Deutsche Bank’s Equity Prime Services Group surveyed 323 institutions, which held more than half of the global industry’s hedge fund assets, and found the following:

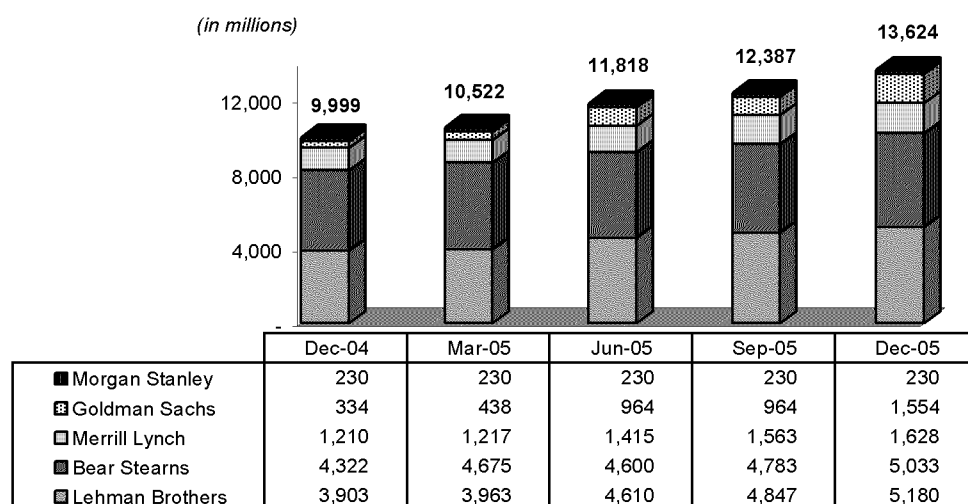
- 32% of the 323 institutions surveyed stated that they currently use structured products to gain exposure to hedge funds.
- Of the 68% that do not use structured products, 30% stated that they intend to use them in the near-term.
- The most prevalent use of hedge fund structured products was for the purpose of gaining leverage where nearly 41% of institutions stated that this was their primary objective in using these instruments.
- The second highest use was for principal protection where 23 % of respondents used hedge fund structured products for hedging against market losses.

⁹ Jason Ekaireb, Head of Hedge Fund Derivatives Trading, Goldman Sachs.

STRUCTURED FUND PRODUCTS AT THE CSE FIRMS

Among the five CSE firms, the largest issuers of Hedge Fund Derivatives are Lehman Brothers and Bear Stearns. As of December 31, 2005, Lehman Brothers had \$5.2 billion notional in hedge fund derivative products outstanding and Bear Stearns had \$5.0 billion. Merrill Lynch and Goldman Sachs each had approximately \$1.6 billion in hedge fund derivatives outstanding while Morgan Stanley had only \$230 million. Prior to the 2nd quarter of 2005, Bear Stearns had the largest notional balance outstanding among the five CSE firms (with Lehman a close second). Lehman, however, experienced significant growth in leveraged products and principal protected notes in the 3rd quarter of 2005 allowing them to surpass Bear Stearns in total notional outstanding.

Notional Structured Fund Balances by Firm



* Merrill Lynch's balances reflect the NAV of the underliers, not the notional on the structured products

Another important trend worth noting was the rapid growth experienced by Goldman Sachs' structured fund business. In December of 2004, Goldman Sachs had \$334 million in notional outstanding for structured hedge fund linked products. This business grew by 365%, or \$1.2 billion, by the end of 2005. Goldman Sachs' growth was driven primarily by an increase in CPPI products with FoF and single hedge fund underliers. CPPI tied to FoFs grew more than 3 times during 2005 from \$284 million to \$928 million while CPPI tied to single hedge funds grew more than 12 fold from \$50 million to \$616 million.

Portfolio Composition

Principal Protected Notes ("PPN"), Options, and Total Return Swaps ("TRS") are the three largest structured fund product groups offered by the CSE firms. As of 12/31/05, the CSE firms had approximately \$13.6 billion in total notional value of hedge fund derivative products with PPNs accounting for 52% (or \$7.1 billion) of the total notional value. Options, predominately CPPI type options, made up 22% (or \$3.0 billion) of the total portfolio; and TRS comprised 8% (or \$1.1 billion) of the total portfolio. The "Other" product category,

which totals \$2.4 billion, includes instruments such as certificate pass-through and margin loan leverage products

When broken out by region, CSE structured fund businesses tend to be predominately concentrated in Europe with a small but growing presence in Asia. All firms, except Bear Stearns, issue most (if not all) of their structured fund products outside of the US. Bear Stearns was the exception where 71% of their products are issued in the US and 29% issued in Europe.

Portfolio Composition (*In millions*)

By Product	Bear Stearns	Lehman Brothers	Merrill Lynch	Goldman Sachs	Morgan Stanley	Total	% of Total
Options							
CPPI	\$ 2,565					\$ 2,565	19%
American/European/Asian	\$ 264	\$ 203				\$ 467	3%
Principle Protected Notes	\$ 457	\$ 3,218	\$ 1,628	\$ 1,554	\$ 230	\$ 7,087	52%
TRS	\$ 1,107	\$ -	\$ -			\$ 1,107	8%
Other	\$ 640	\$ 1,759				\$ 2,399	18%
Total	\$ 5,033	\$ 5,180	\$ 1,628	\$ 1,554	\$ 230	\$ 13,624	100%

By Region	Bear Stearns	Lehman Brothers	Merrill Lynch	Goldman Sachs	Morgan Stanley	Total	% of Total
United States	\$ 3,573	\$ 1,088	\$ 56	\$ -	\$ -	\$ 4,717	35%
Europe/Asia	\$ 1,459	\$ 4,092	\$ 1,572	\$ 1,554	\$ 230	\$ 8,907	65%
Total	\$ 5,033	\$ 5,180	\$ 1,628	\$ 1,554	\$ 230	\$ 13,624	100%

Principal Protected Notes

For investors, principal protected notes offer the ability to gain hedge fund exposure with protection of capital at maturity, and provide structuring flexibility for institutional investors. The CSE firms generally offer two types of principal protected instruments—CPPI Notes and Fund-Linked Notes (“FLN”). Of the two, CPPI based notes account for a much larger portion of the firms’ portfolios than do FLNs.¹⁰ When combined with the large amount of CPPI options issued by Bear Stearns—\$2.6 billion as of 12/31/05—CPPI instruments (i.e., notes and options) generate the most revenue and risk for hedge fund derivative products across the five CSE firms—71% (or \$9.7 billion) of the \$13.6 billion of the firms’ total portfolios is comprised of CPPI structures.

Because CPPI is the dominant product at the firms (from both a revenue and risk perspective), we include an example that helps explain the complexities and risks associated with these transactions. The discussion on CPPI transactions is followed by shorter discussions on other popular structured hedge fund products. The example in the CPPI section below describes how Lehman Brothers, who is the largest issuer of CPPI notes, structures its CPPI transactions. Following the example, we provide commentary on how this example differs from CPPI transactions at other CSE firms.

¹⁰ See “Fund Linked Note” section below for additional information on why firms prefer to issue CPPI notes over fund linked notes.

Constant Proportion Portfolio Insurance (CPPI) Notes

CPPI notes are instruments that, through the rebalancing of funds between a risky asset (i.e., a single hedge fund or a fund of hedge funds) and a risk-free asset (typically zero-coupon bonds or cash), provide investors with a way to gain exposure to hedge fund returns with principal protection. The payout of a CPPI structure is path dependent with two important elements that determine the product's final payout. First, a predetermined de-leveraging formula into risk-free assets provides *downside protection* should the underlying portfolio perform poorly. Underperformance of the fund could result in the risk that participation in hedge fund performance could fully knock out; thus, leaving the investor with a fixed income investment (e.g., a zero coupon bond) or cash investment. The second important characteristic is that CPPIs provide *increased participation in the upside* (allocation to the risky assets) when the underlying hedge fund performs well.¹¹

The ability for CPPI instruments to provide downside protection and increased upside participation is made possible by a number of transaction terms as defined below:

- **Exposure Formula** – The exposure formula is the allocation mechanism that is used to determine the proportion of the CPPI investment in the risky asset where the exposure to the risky asset is equal to the target leverage times the NAV minus the bond floor (i.e., $\text{Exposure} = \text{Target Leverage} \times [\text{NAV} - \text{Bond Floor}]$).
- **Target Leverage Ratio** – The target leverage ratio is the “desired” leverage in the CPPI structure. The decision on where to set the ratio is generally based on the redemption liquidity provided by the underlying hedge fund, the volatility of the funds NAV, and the diversification of the fund. Secondly, firms might consider the credit worthiness of the client investing in the CPPI product.
- **Maximum Leverage** – is the upper bound of leverage that a CSE firm is comfortable providing through a CPPI structure. If leverage in the CPPI instrument exceeds the maximum leverage, firms will de-lever to decrease the amount of leverage being provided. When structures de-lever, shares in the risky asset (i.e., hedge fund shares) are redeemed and proceeds are used to pay down borrowed funds. Similar to the target leverage ratio, the maximum leverage ratio is primarily a function of the underlying hedge funds liquidity, volatility, and diversification.
- **Minimum Leverage** – is the lower bound of leverage in a CPPI structure.
- **Bond Floor (“BF”)** – specifies the level of principal protection, which generally begins at an initial “discounted” level, and then accretes to 100% of the principal protection at maturity. The bond floor is set to the present value of a zero coupon bond with a maturity equal to that of the CPPI structure.

¹¹ Not all CPPI structures allow for increased participation in the upside. Morgan Stanley and Goldman Sachs, for example, do not allow more than 100% participation.

- **Maturity** – varies from structure to structure with common maturities ranging from 3 to 7 years. CPPI structures can be held to maturity or may be redeemed early. In the event of an early redemption, the investor is not entitled to the full “principal protection” amount. Instead, the investor receives a discounted amount that is equivalent to the bond floor at the time of redemption.
- **Trigger Event** – is the minimum level to which the NAV can fall before the structure knocks out. In the event of a knock out, the structure fully divests from the risky asset and invests in the risk-free asset. The trigger event is usually set at some level above the bond floor (e.g., 7% above the bond floor) to allow for the amount of time it takes to redeem hedge fund shares. Additionally, the trigger level accretes with the bond floor as time passes.

While parameters may differ from firm-to-firm (and from one transaction to the next), the assumptions used in our example generally reflect those encountered at the CSE firms.

Initial investment in the risky asset = 100%

Capital (or Principal) Guarantee = 100% of principal at maturity

First de-leverage point – Initially set at 90% of the risky asset’s NAV, and then accretes to 120% at maturity (which provides a constant 20% cushion to the 70% bond floor parameter below). The first de-leverage point is similar to a maintenance margin. The structure will not de-lever until this line is reached, which minimizes the buying and selling the client has to face over time.

Trigger Line – Initially set at 77% of the risky asset’s NAV, and then accretes to 107% at maturity (which is a constant 7% cushion above the 70% bond floor parameter below). The trigger line is similar to a clean-up call where the firm will completely divest from the risky asset and buy zero coupon bonds or pay out the remaining proceeds in the form of cash.

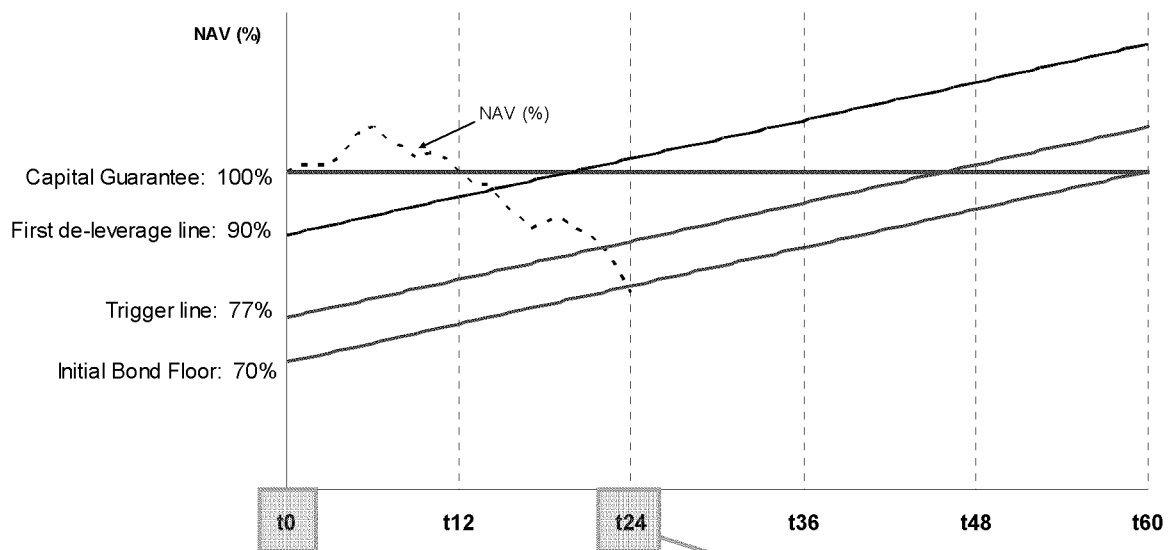
Bond Floor (initially) = 70% of the risky asset’s NAV, and accretes to 100% at maturity. A bond floor can be fixed or floating. If the bond floor floats, then interest rate risk is mitigated as interest rates rise or fall. A fixed bond floor can either be fixed at a specific value (i.e., 70%) or can accrete at a fixed rate (i.e., will have an initial value of 70%, but will accrete to 100% at maturity using straight line appreciation). The latter is considered fixed because the accretion schedule is fixed subjecting the issuer of the CPPI note to interest rate risk.

Target Leverage = 3.33x (in this example)

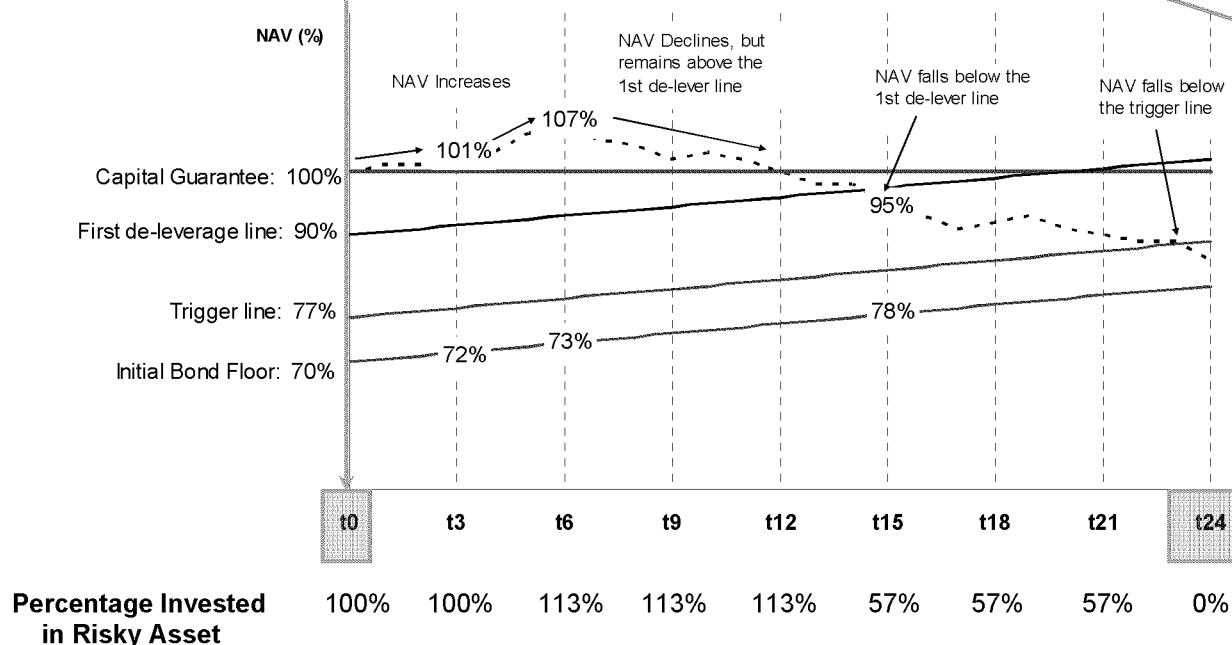
Visually, these parameters are represented as shown in the graphs below. The investment in the risky asset is driven by the change in the NAV (as represented by the dotted line). The capital guarantee of 100% is represented by the solid green line, the first de-leverage point by the solid blue line, and the trigger line and bond floor by the solid red lines. The decision of whether to lever up or de-lever in the CPPI structure is driven by the relationship of the NAV to the first de-leverage line, the trigger line, and the bond floor.

The top graph depicts a 5-year CPPI structure and the bottom graph represents the first 2-years of the 5-year structure. The 2-year view, with greater detail, is provided to better illustrate the impact that increases and decreases in the NAV have on the instrument. The examples that follow the graphs reference the bottom graph (the first 2-years of the structure), and assume quarterly liquidity.

CPPI Structure (5-Year Maturity)



First 2-years of the structure (Assuming Quarterly Liquidity)



NAV Increases

For an increase in NAV, there are two basic scenarios to consider: (1) the NAV (%) increases, but by an amount less than the bond floor accretes; and (2) the NAV increases by more than the bond floor accretes. It is important to note that the increase in the NAV must be greater than the accretion in the bond floor for the CPPI to lever up.

If, for example, the *NAV increases, but by less than the bond floor accretes* (say from 100% at t0 to 101% at t3) [See bottom graph above], you might expect the structure to lever up, but this is not the case—the exposure to the risky asset remains unchanged. This is because the NAV only increased by 1% while the bond floor accreted by 2% (from 70% to 72%); thus, resulting in the following exposure calculation: $3.33 \times (101 - 72) = 97\%$. Additionally, the structure will not de-lever from 100% to 97% (as the calculation suggests) because the NAV (%) is greater than the first de-leverage line. This example shows that it is possible to experience an increase in the NAV, but not an increase in exposure to the risky asset.

If the *NAV increases by more than the bond floor accretes* (say from 100% at t0 to 107% at t6), then the amount of exposure to the risky asset will increase. This is because the NAV increased by 7% while the bond floor only accreted by 3%. The exposure will increase from 100% of the risky asset to 113% [$3.33 \times (107 - 73) = 113\%$]. The structure would have to borrow an amount equivalent to 13% of the NAV to purchase the additional shares.

NAV declines

When considering the impact of a decrease in NAV on the CPPI structure, there are three basic scenarios to consider: (1) the NAV declines, but not enough to fall below the first de-leverage line; (2) the NAV falls by more than the first de-leverage line (but remains above the trigger line); and (3) the NAV falls below the trigger line.

If the *NAV declines, but remains above the first de-leverage line*, then the CPPI structure will not de-lever, and the exposure to the risky asset will remain at its highest level—113% in the example above. It is important to note that the de-leverage line accretes at a constant proportion to the bond floor—20% above the bond floor in the example above—as you move toward maturity. The implication is that the risky asset should (at a minimum) provide a rate of return comparable to (or preferably greater than) the risk-free asset.

If the *NAV falls below the first de-leverage line* (as it does between t12 and t15), then the structure will de-lever and the portion allocated to the risky asset will be reduced according to the exposure formula. If, for example, the NAV declines by 12% (from 107% to 95%), the exposure to the risky asset will decrease from 113% to 57% [$3.33 \times (95\% - 78\%) = 57\%$].

If the *NAV falls below the trigger line* (as it does between t21 and t24), then the structure will fully divest from the risky asset and the proceeds will be used to purchase zero coupon bonds.

The CPPI example above is often referred to as a “classical” CPPI structure where the note issuer (i.e., the CSE firm) uses investor proceeds to purchase shares in a reference hedge fund

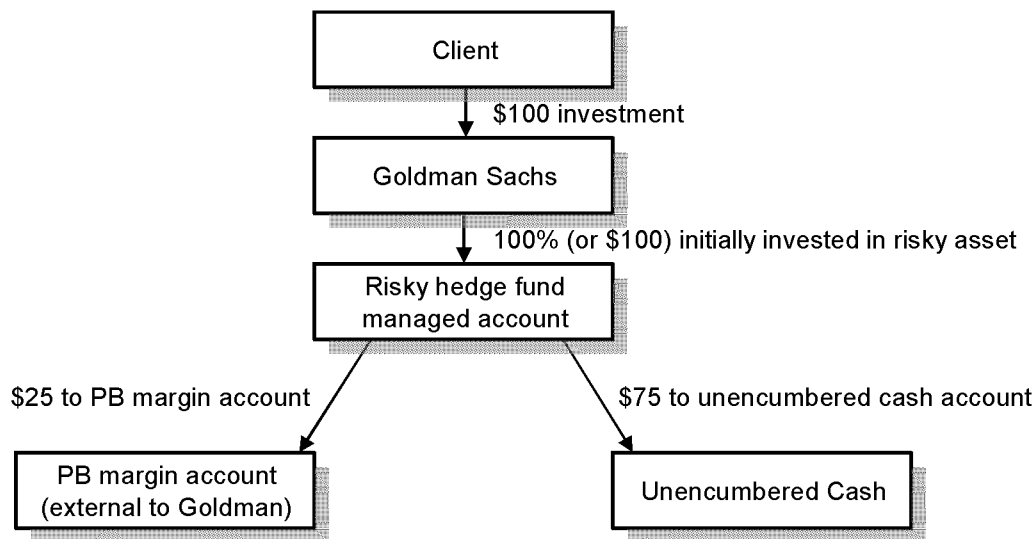
and passes the economics of the structure on to the investor. Alternatively, CPPI structures can be created synthetically where the instrument offers hedge fund exposure, but achieves the exposure by purchasing a zero coupon bond (which at maturity provides principal protection) and a call option on a referenced portfolio. Similar to the classical structure, a synthetic CPPI instrument utilizes an allocation formula to determine the exposure to the risky asset; and passes the economics of the call option on to the investor.

Of the five CSE firms, Lehman Brothers is the largest issuer of classical CPPI notes while Bear Stearns issues a large amount of synthetic instruments (i.e., CPPI options). Approximately 62% of Lehman's structured funds portfolio consists of classical CPPI notes while approximately 51% of Bear's portfolio is made up of synthetic style CPPI options. For all CSE firms, across all structured product types, the total portfolio composition contains 52% classical CPPI notes and 19% synthetic CPPI options with the remainder being TRS and other transactions. Both classical and synthetic CPPI structures are exposed to "Gap risk," but classical structures contain the additional burdens associated with administering a referenced hedge fund; and can be exposed to interest rate risk that arises from fixed bond floors. In contrast, synthetic structures (i.e., a zero coupon bond plus a call option) exposes the firm to the risk of delta hedging the option. These risks, along with other differences between firms' CPPI structures (such as visibility of hedge fund assets and redemption liquidity), are discussed in detail in the Risk Management section.

Goldman Sachs CPPI transaction on single hedge fund shares – Goldman's CPPI structures, on single hedge fund shares, are "unique" in that the structure transfers most if not all of the gap risk to an external prime broker (e.g., Morgan Stanley's prime brokerage). Goldman Sachs achieves the transfer of gap risk with two structural terms that are not found in other firms' CPPI transactions: (1) Goldman uses an external prime broker to provide leveraged hedge fund exposure and (2) Goldman uses non-recourse contracts to ensure that the external prime broker only has recourse to the initial margin posted. The easiest way to understand this transaction is through an example. Similar to other CPPI transactions, Goldman's structure uses an exposure mechanism to allocate funds between a risky asset and a risk-free asset.

Goldman's CPPI structure is initially set up as follows:

1. Goldman receives a \$100 investment from a client.
2. 100% (or \$100) is initially invested in the risky hedge fund asset. It is important to note that the "risky asset" is a combination of two accounts—a prime brokerage account (external to Goldman Sachs) and an unencumbered cash account. Both accounts are administered through a separately managed hedge fund account.
 - a. Prime Brokerage margin account – Through a hedge fund, Goldman obtains \$100 worth of hedge fund exposure for their client by posting \$25 worth of margin.
 - b. Unencumbered cash account – The remaining \$75 of the initial investment is deposited in a cash account at a bank, which provides principal protection.



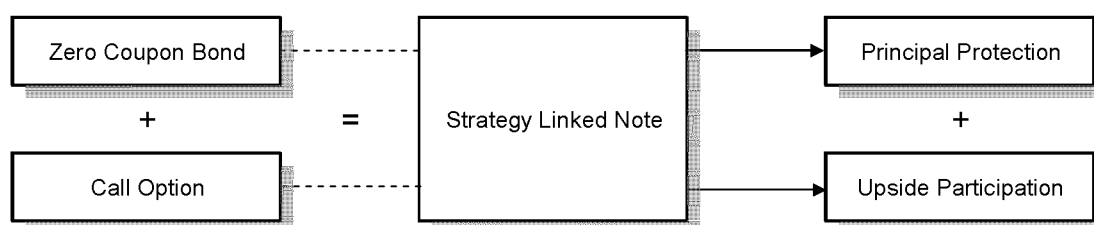
A key component to this transaction is the fact that Goldman Sachs does not use their prime brokerage to provide leverage. By generating leverage through an external prime broker, Goldman Sachs is able to shift most of the gap risk away from Goldman and to the prime broker.¹² For example, if the market collapses and the hedge fund gaps down by \$30, the CPPI allocation formula would dictate that \$0 be allocated to the risky hedge fund. The prime broker, who has the initial \$25 margin, would request \$5 more in margin to cover the current position, and another \$25 in margin to re-establish \$100 worth of hedge fund exposure—neither of which would be paid. Instead, the hedge fund would close out the positions with the prime broker leaving the PB with a \$5 loss. While the PB may request the additional margin, there is no expectation that the \$5 will be paid because they are required to sign a limited recourse contract at the onset of the CPPI transaction, which only provides for recourse to the initial margin posted.

The limited recourse contract also provides another key component to this transaction—protection of the \$75 in the unencumbered cash account. If the CPPI structure knocks out, the \$75 is paid to Goldman Sachs (which is used to provide principal protection), with the PB having no recourse to the cash. Goldman Sachs indicated that prime brokers are willing to enter into limited recourse transactions because (1) the PB makes their credit decision based on the margin posted, not on the value of the excess equity (i.e., the \$75 in the unencumbered cash account), and (2) the PB imposes a slightly higher margin-to-equity premium for giving up the right to recourse.

¹² Because of the allocation mechanism, it is possible for Goldman to be exposed to a small portion of the gap risk. The allocation formula contains a multiplier that dictates the amount of client equity required and leverage allowed in the structure. If, for example, the target leverage is 4 times, this equates to a multiplier of 4. The reciprocal of the multiplier (e.g., 1/4, or 25%) is the level of client equity held at the PB as margin. If a decline in the NAV causes the multiplier to increase, say to 4.9, but not enough to trigger a de-leverage event, then Goldman will be exposed to a small portion of the gap risk. At a multiplier of 4.9, Goldman is exposed to just under \$5 of the \$25 gap risk ($1/4 - 1/4.9 = 25\% - 20.41\% = 4.59\%$).

Fund Linked Notes (“FLN”)

Fund linked notes are hybrid securities that contain elements of both debt and hedge fund investments. As depicted in the diagram below, FLNs are constructed by packaging a call option and a zero coupon bond where the zero coupon bond accretes to par at maturity (providing principal protection), while the call option provides exposure to the hedge fund’s return. Unlike the CPPI based PPN, there is no allocation mechanism that provides rebalancing between the risky asset and risk free asset; therefore, the final payout is not path dependent. Additionally, participation in the underlying fund(s) is fixed (i.e., there is no risk of the structure knocking out).



As previously discussed, CSE firms have issued much more CPPI notes than FLN. The preference of CPPI issuances over FLN issuances is, at least in part, due to the arduous task of delta hedging call options, on relatively illiquid hedge fund underliers, in FLN structures. Whereas FLNs require delta hedging of call options, CPPI based notes transfer this risk to clients through the formulaic nature of the exposure mechanism.¹³

Total Return Swap (“TRS”)

Similar to principal protected notes, TRS provide leveraged hedge fund exposure. TRS do not, however, provide protection of principal. Total return swaps are similar to interest rate swaps in that there are periodic exchanges of cash flows between two counterparties. The uniqueness, in TRS, comes from the referenced assets, which are typically portfolios of hedge funds, hedge fund indexes, or (to a lesser degree) single hedge funds. The cash flows between a TRS issuer and a counterparty are as follows:

Issuer (i.e., the CSE firm)

- Pays the upside related to the performance of the reference portfolio, fund, or index.
- Receives the downside related to the performance of the reference portfolio, fund, or index plus a Libor or Fed Funds based floating rate fee.¹⁴

¹³ While the CPPI structure vastly mitigates the delta hedging requirements seen in FLN structures, there may be market risk if the payoff to the investor is not strictly aligned with the reallocation performed by the firm. While we confirmed with Goldman and Lehman that the payout in their then current portfolio is aligned with their reallocation mechanisms, this may not always be the case going forward. Firms might rebalance differently than what the payout assumes for various reasons including taking a trading view or reduction of transaction costs.

¹⁴ The gap risk associated with TRS structured fund products is taken into consideration when calculating the spread over Libor (or the Fed Funds rate). Bear Stearns accomplishes this in their Equity Capital Model.

The counterparty (i.e. fund-of-fund manager or investor)

- Pays the downside related to the performance of the reference portfolio, fund, or index plus a Libor or Fed Funds based floating rate fee.
- Receives the upside related to the performance of the reference portfolio, fund, or index.

Bear Stearns is by far the largest issuer of TRS on hedge funds with \$1.1 billion in outstanding notional balance (as of December 2005) with Merrill Lynch a distant second at \$93 million.¹⁵ At Bear, the vast majority of TRS are done on an initial collateral plus mark-to-market basis without consideration for counterparty creditworthiness. This is because a majority of the counterparties are unrated. Alternatively, for the few TRS counterparties that are rated, collateral is posted based on the counterparty's creditworthiness ranging from unsecured for highly rated counterparties to 25% to 50% initial collateral, plus mark-to-market, for less creditworthy counterparties.

Typical TRS transactions provide 2 to 4 times leverage and incorporate annual deal break clauses where either side can terminate the transaction, and termination triggers for sharp NAV declines or material changes in reference asset volatility. Additionally, Bear Stearns and Merrill Lynch mitigate their market risk exposure by purchasing the underlying hedge fund(s) or hedge fund index leaving them with counterparty credit risk to the investor.

Options and Warrants

Among CSE firms, the largest issuer of call options and warrants on hedge funds (which are generally executed over-the-counter) is Bear Stearns. As of year end 2005, Bear Stearns had \$2.8 billion notional in options and warrants outstanding. The vast majority of those instruments, \$2.6 billion, were CPPI options while \$264 million were American, European, and Asian style options. The referenced assets for the instruments are typically not single funds, but rather a portfolio of funds or a hedge fund index. Maturities for options and warrants range from one to seven years; and the pay-off to the investor is usually cash-settled. Aside from Bear Stearns, the only other CSE firm active in this product space is Lehman Brothers who had \$203 million in outstanding options as of December 31, 2005. In total, options and warrants (predominantly CPPI options) accounted for 22% of the firms' total hedge fund derivative portfolios.

Other Structured Fund Products

Other structured fund products include Collateralized Fund Obligations ("CFO"), portable alpha structures, and pass-through certificates.¹⁶ The only firm issuing CFO or portable alpha structures is Lehman Brothers. Bear Stearns is the only issuer of pass-through certificates.

¹⁵ In Merrill Lynch's data submitted to OPSRA, the last balance available for TRS products was as of 11/30/05.

¹⁶ Firms also issue a small amount of Periodic Reset Options ("PRO") and Black Scholes Options on hedge fund shares. These are not discussed because of their relatively small balances and limited growth.

Collateralized Fund Obligation

A CFO is a structured security that, similar to TRS, provides leveraged exposure to the performance of an underlying hedge fund. The capital structure of a CFO resembles that of a traditional Collateralized Debt Obligation (“CDO”) where the instrument is typically issued from a Special Purpose Vehicle (“SPV”) and consists of both senior debt and subordinated equity tranche securities. In a CFO, an investor gains leveraged exposure to the underlying asset of their choice where their loss is limited to the principal amount of the subordinated notes. From the issuer's perspective, this structure allows the firm to separate the financing from the leveraged investment, which gives the firm more funding, pricing, and gap risk management options.

A typical CFO transaction might be structured as follows:

1. Senior Note (Debt) – The issuer (i.e., CSE firm), through an SPV, underwrites senior notes that can either be held by the issuer, or sold to institutional investors such as banks. If the senior note is sold, then the issuer can either offload the gap risk to the investor, or can retain the gap risk by concurrently issuing Credit Default Swap (“CDS”) protection to the debt buyer. Risk managers at Lehman Brothers indicated that their preference is to retain the gap risk by holding the senior note and hedging the risk because it is more cost effective than offloading the risk by selling the note.
2. Subordinated Note (Equity) – is sold to investors seeking equity type exposure to hedge fund returns.
3. NAV Appreciates – During the term of the CFO transaction, if the NAV of the underlying hedge fund appreciates, the SPV can issue additional senior notes to finance the purchase of new shares in the underlying hedge fund(s). When issuing additional senior notes and purchasing new shares, the structure is required to maintain a target level of subordination.
4. NAV Declines – If the NAV of the underlying hedge fund declines, the SPV will buy back a corresponding portion of the senior notes by redeeming the shares in the underlying fund. Again the structure maintains the target subordination.
5. Payout – The payout on the subordinated note is equal to the maximum of the fund NAV (at maturity) minus any outstanding principal balance of the senior notes, or zero. The payout on the senior note is simply a Libor based coupon (e.g., Libor plus 30 basis points).

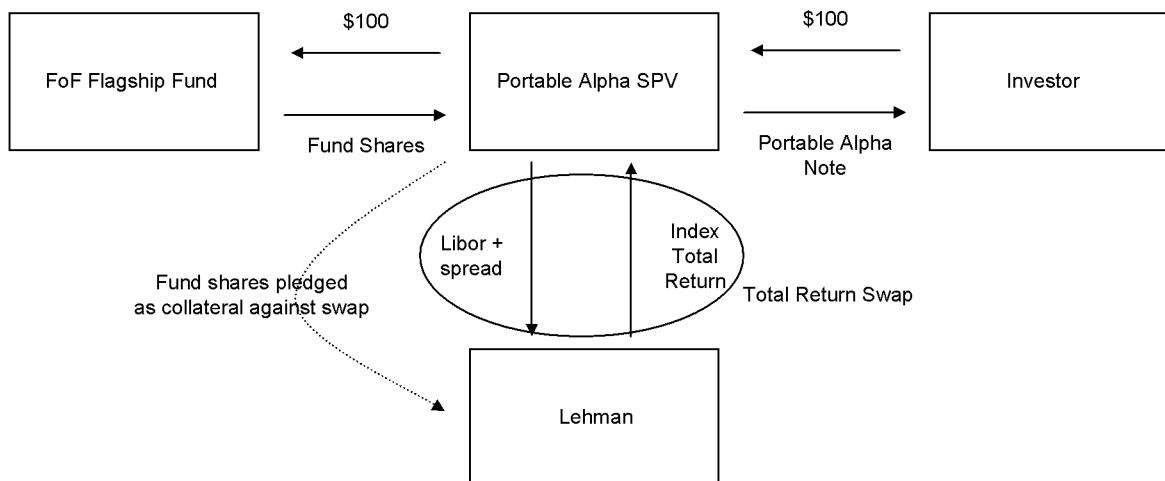
Portable Alpha¹⁷

Portable Alpha is a strategy that allows the alpha return that is generated in one investment to be transported onto a market return benchmark. From the CAPM model ($R_i = \alpha + \beta R_m$), 'beta' refers to the return on a portfolio attributable to the market and 'alpha' refers to return in excess of the market return. Portable Alpha refers to the idea that alpha and beta can be generated separately. That is, the investment vehicles that generate alpha are uncorrelated with the investment vehicles that generate beta. The alpha is then ported onto the beta.

Investors have always been able to duplicate the basic idea of portable alpha. As an example, an investor could put part of a portfolio into a fund to generate alpha and simultaneously enter a total return swap on an index to get the beta. The investor would, however, not be able to invest the entire portfolio in the alpha-generating vehicle and would need to keep part of the portfolio as cash in order to meet the payments of the total return swap. Investing in Lehman's product allows for the entire portfolio to be invested in the alpha generating vehicle.

The typical Portable Alpha product at Lehman gives the investor exposure to fixed income markets via the return on the Lehman Aggregate Index as well as exposure to hedge funds via the return on various FoFs. The alpha return from the FoFs investment is combined with the market return of the Lehman Aggregate Index to provide the investor with alpha and beta returns.

In this example, the beta is generated via derivatives as the return on an index (either S&P or a fixed income index), and the alpha is generated as the return to a FoF.



Following the diagram above, the cash flows are as follows:

1. The investor pays \$100 and in return receives a Portable Alpha Note.

¹⁷ Source: Michelle Danis, "Lehman Brothers' Portable Alpha" write-up: J:\Ora\Other\CROSS-FIRM ISSUES\Cross-firm Basel issues\Lehman Brothers\Portable Alpha.doc

2. The \$100 investment is used by an SPV to purchase shares of the FoF Flagship Fund, which invests in any type of particular strategy.
3. Simultaneously, Lehman enters into a total return swap with the SPV with a notional equal to the amount invested in the FoF Flagship Fund. Note that the notional of the swap ramps up and down monthly as the NAV of the FoF changes. Lehman receives LIBOR plus a spread and pays the return of an index (either the S&P or a fixed income index). The fund shares are pledged as collateral against the swap.
4. The return on the note equals the return of the FoF “Flagship Fund” plus the return of the Index less the financing charge on the swap. The investor gets exposure to the index (the beta, or market return) through the TRS transaction and to the hedge funds (the alpha, or excess return), which could come from any number of investment strategies.

Portable alpha is one of Lehman’s fastest growing structured hedge fund products. Lehman currently has \$1 billion notional in this product, with \$900 million referencing a fixed income index and the remainder referencing the S&P 500. The firm expects that this product base will more than double by year end 2006. The typical Portable Alpha Note has a tenor of from one to five years.

Pass-through Certificates

Pass-through certificates provide a synthetic investment in all of the cash-flows from the underlying index or basket. Bear Stearns is the only firm issuing pass-throughs on hedge fund returns. Additional, all of Bear’s issuances have been in Europe or Tokyo (none in the U.S.). Unlike TRS, there is no gap-to-zero risk for the firm because the certificate is fully funded by the investor (e.g., the investor buys a pass-through certificate for \$100, and Bear purchases \$100 of the underlying asset and simply passes the economics of the transaction to the investor). Bear Stearns’ typically earns a 30 to 50 basis point annual fee on this type of transaction.

RISK MANAGEMENT

Major risk factors for hedge fund derivative products include market risk, counterparty credit risk, and operations risk (including legal and compliance risk). There are four major market risks that risk managers at CSE firms focus on: (1) Gap Risk; (2) Delta Hedging Risk; (3) Liquidity Risk; and (4) Interest Rate Risk. The predominant risk is gap risk—the risk that the underlying hedge fund’s NAV falls, beyond a pre-specified level (i.e., trigger level), faster than a firm can de-leverage out of the risky hedge fund asset.

The method used to manage these risks is dependent on the business model utilized by the firms, and on the product type. For structured fund products based on multiple underliers (i.e., FoFs and hedge fund indexes), firms find that there is a lack of transparency into the hedge fund assets and that there are liquidity constraints. Because of these constraints, risk management primarily focuses on ensuring that the structures contain diversified pools of investments, and that they employ multiple contractual safeguards (i.e., NAV triggers,

volatility triggers, and rights to break trades). Those firms with business models that provide structured products on single hedge funds (i.e., Morgan and Goldman) rely on enhanced transparency and liquidity, or “unique” structural terms to mitigate the market risks associated with these products because the benefits of diversification are not available.

Risk classification (i.e., market risk or counterparty credit risk) is also a function of the product type. Where as TRS primarily generate counterparty credit risk,¹⁸ the other products generally create market risk for the firms in the form of gap risk or delta hedging risk.

Market Risk

Gap Risk

For small movements in NAV, gap risk is minimized as the CPPI allocation mechanism reduces the exposure to the risky hedge fund (or FoF) and increases investment in the risk-free asset. However, the benefit of the CPPI allocation mechanism may be diminished for funds with volatile NAVs, especially if the fund has a long redemption period (i.e., higher liquidity risk) where the NAV has a longer period of time to gap down before the firm is able to de-lever out of the risky asset by redeeming hedge fund shares. Where the firm provides leverage for the portion of the portfolio allocated to the risky asset, it has recourse only to the risky asset; therefore, gaps can leave the firm facing losses.

Risk managers at most of the CSE firms indicated that monitoring and managing gap risk encompasses both qualitative and quantitative nuances. The primary means of managing gap risk occurs at the outset where due diligence is performed to ensure that (1) each trade conforms to investment guidelines that promote proper diversification and acceptable liquidity and (2) that each trade has multiple structural safeguards built into the contract. Lehman refers to this as “*qualitative*” *risk management*, which (at both Lehman and Bear) is undertaken by front-office personnel. On an ongoing basis, independent risk managers perform the qualitative risk management functions of monitoring diversification levels and structural safeguards.

Ensuring proper levels of diversification and acceptable liquidity increases the likelihood that a transaction can withstand multiple fund defaults and significant performance deterioration within any particular investment strategy. Diversification is monitored in various fashions, but the firms generally focus on concentrations in FoFs, concentrations in single hedge funds, and hedge fund strategy concentration. Firms also closely monitor the liquidity (i.e., redemption period) for underlying hedge funds. With respect to FoF and single hedge fund concentrations, firms tend to be concerned with the size of the largest FoF and single fund positions as well as what their weights are in the total portfolio. With respect to strategy diversification, CSE firms

¹⁸ For TRS that are based on hedge fund share collateral, the firm may be exposed to market risk if the swap is not completely hedged at issuance. Typically, credit departments only approve TRS trades where trade approval is dependent on the credit worthiness of the counterparty (e.g., AAA rate pension funds). However, in most cases, firms have determined that they do not have recourse to a credit worthy counterparty, and generally rely on large initial margins (25% to 50%) plus mark-to-market to compensate for the risk. The market risk department will monitor these risks along with the market risks from other products (e.g., gap to zero). See the “Counterparty Credit Risk” section below for additional details.

try to minimize their exposure to individual strategies by diversifying across many strategies. This typically results in a total hedge fund derivative portfolio with strategies that closely mimic the overall hedge fund industry.

Another important aspect of “qualitative” risk management is ensuring that the proper structural safeguards are in place. Structural safeguards include NAV triggers, volatility triggers, and annual rights to break trades. One of the key safeguards that the businesses use is to set their trigger levels well below the initial level of customer equity in the trade (e.g. a first de-leverage trigger for a 3.5% decrease in NAV on a trade that has initial customer equity of 25%). Assuming a multi-stage gap, this early trigger is a very valuable risk mitigant. Basically, this allows the business to unwind trades, or de-lever out of risky assets, well before customer equity is depleted.

Managing gap risk also requires “*quantitative*” risk management, which is undertaken by independent risk managers. In addition to the ongoing qualitative risk management mentioned above, independent risk managers monitor first and second order Greeks, VaR measures, Expected Tail Loss measures, and major trade exposure detail. First and second order Greeks (e.g., delta, gamma, and vega) are captured within VaR, but since VaR measures do not generally focus on extreme tail or stress events (like those that generate gap risk), firms also look at specific tail loss measures and maximum exposure (i.e., gap-to-zero) measures.

Lehman sets limits based on VaR, on strategy and portfolio concentration, and on expected tail losses. Expected tail losses measure the potential mark-to-market loss on positions due to gap risk in underlying fund NAVs. These losses represent the distance below the bond floor when Lehman shocks the NAV on each trade. Bear Stearns and Merrill Lynch, in addition to VaR and concentration limits, set limits based on “gap-to-zero” measures where the gap exposure is net of customer equity held. These limits generally include maximum gap-to-zero exposure for the entire portfolio; and maximum gap-to-zero exposures to any one FoF family, FoF, or single hedge fund.¹⁹

Delta Hedging Risk

For options (including CPPI options), warrants, and certain principal protected notes (i.e., FLNs), the firms are exposed to market risk as they are obligated to deliver hedge fund performance related returns to the investors in exchange for an upfront and/or periodic payment. Hedge fund options create market risk exposure for CSE firms as they delta hedge the call options that they have written. This exposure is exacerbated by the relative lack of liquidity in the underlying hedge fund shares compared to more common option products in the equity derivatives market.

Liquidity Risk

Liquidity risk in structured fund products arises when a CSE firm is unable to redeem hedge fund shares due to redemption constraints. At firms with structured fund products based on

¹⁹ See the “Capital Calculation Methodology” section below for additional information on how the firms calculated expected tail losses and gap-to-zero.

multiple underliers (i.e., FoFs and hedge fund indexes), liquidity risk is mitigated through diversification, and by limiting the leverage provided for less liquid funds. For example, a structure containing a diversified FoF with monthly liquidity would be allowed more leverage than a less-diversified FoF with quarterly liquidity.

Morgan Stanley, whose business model relies on structured products tied to single hedge funds, depends on complete transparency and enhanced liquidity to mitigate the market risks associated with these products as the benefits of diversification are not available. To date, Morgan has achieved this by only doing transactions where they are the sole prime broker; and have only provided CPPI structures on one fund—Cheyne.²⁰ Additionally, risk managers stated that the firm must be able to get a perfected interest in the underlying collateral, meaning that the hedge fund must set up a separate managed account for the assets on which a CPPI is written. Having a separate managed account allows the hedge fund to provide separate liquidity terms for the CPPI structure than those offered in the main hedge fund.

With respect to their Cheyne CPPI trade (which accounts for \$165 million of their total \$230 million portfolio), Morgan Stanley gets five day liquidity versus the normal 30 day liquidity in the main hedge fund. Having a separate managed account (with the associated upfront disclosure to all parties) also allows the firm to “see across the wall” into the underlying positions held by the firm. Thus, not only does Morgan Stanley (as Prime Broker) have visibility into the positions, but Morgan Stanley structured funds personnel (as the writer of the CPPI note on the separate managed account) also have daily visibility into the positions in the managed account. Daily visibility gives the firm the ability to take offsetting positions to hedge positions in the managed account if they become concerned about the risk of positions gapping down during the five day redemption period.

Interest Rate Risk

Principal protected notes create interest rate risk when a structure’s investment allocation formula is linked to a fixed bond floor that does not vary with movements in interest rates. This is especially true for structures that allocate their risk-free portion to cash (instead of purchasing a zero coupon instrument at inception), while tying the level of guaranteed principal to a fixed income instrument (e.g., to the accretion of a zero coupon bond’s value). Not purchasing a zero coupon bond at inception creates uncertainty about the cost of purchasing in the future should the structure knock out (i.e., fully de-lever out of the risky asset into the risk free asset). For example, if a five year structure gaps down by 25% and knocks out in the second year, and the principal guarantee is 100% at maturity, then the firm will have to decide how to meet the 100% guaranteed principal payment in three years. If a zero coupon bond were purchased at inception (for 75% of the capital guarantee), the bond would simply accrete to 100% at maturity, irrespective of movements in interest rates, and the proceeds would be used to make the principal payment. Since, in this example, a zero coupon bond was not purchased at inception, the current price of purchasing the same bond may be more or less than the proceeds available (depending on movements in interest rates over the past two years).

²⁰ The business stated that they would also do these transactions without being the prime broker as long as all transaction data were provided to Morgan Stanley on a daily basis.

Some firms, such as Lehman, provide the investor with a fixed bond floor in which the firm takes on the interest rate risk directly.²¹ This benefits the investor because they will not be knocked out of the investment (or have to de-lever) solely based on movements in interest rates. Alternatively, other CPPI based principal protected notes contain floating bond floors that may cause the structure to knock out or de-lever due to changes in interest rates even if the underlying hedge fund performance does not suffer.

Counterparty Credit Risk

The predominant driver of counterparty credit risk is Total Return Swaps (“TRS”) secured by hedge funds shares. This exposure is mostly borne by Bear Stearns who, as of 12/31/05, was the issuer of 92% of all TRS outstanding. The remaining 8% is attributable mainly to Merrill Lynch who issues TRS directly to investors, and Lehman who uses TRS in their portable alpha structured products.²²

The magnitude of the counterparty credit risk in a TRS is captured in the “gap-to-zero” amount, which represents the notional value of the contract less the collateral posted or the embedded equity (for the investor) in the contract. If the underlying hedge fund(s) or hedge fund indices gap down in excess of collateral posted, the CSE firm would have a net receivable from the counterparty.

For the most creditworthy counterparties (i.e., AAA-rated pension funds), TRS may be done on an unsecured basis or with just a mark-to-market agreement on the Swap. However, for most counterparties in this space, the firm has determined that they do not have recourse to a creditworthy counterparty; thus, the business requires 25%-50% in initial margin plus mark-to-market maintenance margin and these are risk managed by the market risk department.

Other structured products, such as Lehman’s portable alpha transaction, expose the firm to counterparty credit risk stemming from the use of TRS within the structure. The risk to Lehman is that the TRS could move in the money to Lehman (by the return on the index falling and/or LIBOR rising), creating counterparty credit risk to the fund with whom Lehman has signed ISDAs. Under this structure, FoF shares are pledged as collateral; however, these shares have varying degrees of liquidity which may make it difficult for Lehman to redeem shares in a timely manner. There is also the risk that the value of the collateral could decline. The correlation between the index and the fund shares is important, as simultaneous declines in the index and in the NAV of the funds could create uncollateralized counterparty credit exposure.

²¹ The interest rate exposure for these products is hedged on a portfolio basis along with the other interest rate products in Europe.

²² The TRS in the portable alpha structure is used to provide the “beta” return (i.e., market return), and as such, the underlier is either an equity or fixed income index, not an illiquid hedge fund.

Operations, Legal, and Compliance Risk

Operations risk is especially high for structured hedge fund products because of the need to frequently rebalance between portfolio components. This often means that firms have to build specialized applications to monitor these trades with systems and infrastructure flexible enough to facilitate capacity growth. Consequently, managing operations risk requires close coordination between risk managers, front and middle office personnel, product control personnel, and information technology.

Legal and compliance risks arise because of the complex nature of the legal structures that often involve multiple jurisdictions and legal entities, such as Special Purpose Vehicles (“SPVs”). Products such as PPNs use SPVs extensively. Since PPNs account for more than half of all the structured products issued by CSE firms,²³ this is an area that receives a great deal of attention.

At Morgan Stanley, the Cheyne transaction appears unique in that the firm is both prime broker and writer of the CPPI note on the managed hedge fund. Morgan Stanley’s multiple roles in this transaction have led to discussions at the firm and between the firm and OPSRA regarding the potential for conflicts to arise.

Hedging

Hedging of structured fund products is conducted on a regular basis by some, but not all, of the CSE firms. Goldman hedges their FoF structured hedge fund exposure through an option based CFO structure where the payout is based on the percentage movement of a hedge fund index over a 3 month period. If, for example, the index declines by 20% over 3 months, the contract is exercisable at Goldman’s discretion. For a fall of 1998 stress test scenario, the FoF structured hedge fund business is hedged for instantaneous shocks greater than 25%. Goldman does not hedge exposure to structured products tied to single hedge fund shares because most of that exposure (i.e., gap risk) is born by external prime brokers.²⁴

As previously mentioned, a common feature in CPPI structures is to have investment allocation mechanisms with fixed bond floors that do not vary with movements in interest rates. Lehman Brothers hedges this interest rate exposure with interest rate swaps, caps, and swaptions. Lehman also hedges gap risk by structuring gap options (i.e., cliquet puts) for clients, primarily insurance companies, seeking high yield investments. These are essentially put spreads where if a significant gap occurs, Lehman receives a payment. Lehman has issued approximately \$900 million of these cliquet-style put options that reset quarterly, and are 15%-25% out of the money. These products provide approximately \$100 million in gap risk protection for the firm.

Hedging is also done by Bear Stearns and Merrill Lynch for TRS products. As mentioned in the TRS section above, Bear Stearns and Merrill Lynch hedge their market risk exposure on

²³ See Table 1 in the “Hedge Fund Derivative Products at the CSE Firms” section above for additional information on CSE firms’ portfolio composition.

²⁴ See “Goldman Sachs’ CPPI transaction on single hedge fund shares,” in the CPPI Notes section above, for additional information.

TRS by purchasing the underlying hedge fund or hedge fund index shares. This leaves the firms with counterparty credit risk exposure that is managed primarily by market risk managers.

CAPITAL

Capital Treatment

Three of the five CSE firms—Lehman Brothers, Bear Stearns, and Merrill Lynch—include structured hedge fund trades in the trading book and apply capital charges based on VaR plus a gap risk add-on. Because VaR does not generally capture extreme tail or stress events, the VaR capital charges tend to be negligible leaving the gap risk add-on as the primary means of calculating capital for structured funds at these three firms. The gap risk add-on results in moderate capital charges at Lehman and Bear and a comparatively large capital charge at Merrill Lynch.

Firm	Capital Treatment	Notional Balance	Capital Held	Capital / Notional
Lehman Brothers	Trading Book	\$5,180	\$132	3%
Bear Stearns	Trading Book	\$5,033	\$201	4%
Merrill Lynch	Basel I	\$1,628	\$186	11%
Goldman Sachs	Trading Book	\$1,554	\$4	0%
Morgan Stanley	* Trading Book	\$230	\$0	0%

* MS believes that the proper treatment is banking book, but would like to continue using trading book for simplicity.

The remaining two firms—Morgan Stanley and Goldman Sachs—do not calculate a gap risk add-on capital charge; thus, they hold little to no capital on structured fund transactions. Currently, Morgan Stanley holds zero capital against these positions, but recognizes that zero is not the right number (especially if this business grows). The firm believes that capital for these products should be based on a banking book approach, but they would prefer to use trading book treatment for practical reasons. They also feel that certain types of trades (e.g., their \$165 million Cheyne trade) should receive preferential capital treatment due to better liquidity and visibility (which is made possible by a separate managed hedge fund account).²⁵

Up until December year-end, Goldman Sachs applied a VaR market risk charge to their structured fund positions and a credit risk charge to the derivative hedges. Beginning in January 2006, the firm removed the positions from VaR because they felt that the coverage provided by their hedges, combined with the fact that VaR is not a good measure of crash risk, made VaR results immaterial in this product space. Goldman also believes that their CPPI structures are “unique” in that Goldman is able to shift most, if not all, of the gap risk to outside Prime Brokers.²⁶

²⁵ See *Liquidity Risk* section above for additional detail.

²⁶ See “Goldman’s CPPI Transactions” in the CPPI section above for additional detail.

Calculation Methodology

At Lehman Brothers, market risk capital charges on structured products are calculated using VaR plus a gap risk add-on. The gap risk add-on is generated from expected tail losses that measure the potential mark-to-market loss on positions due to gap risk in underlying hedge fund NAVs. These losses represent the distance below the bond floor when Lehman shocks the NAV on a trade-by-trade basis.

To calculate the loss, Lehman cuts the tail of the loss distribution at a 99.5% confidence level, and then uses the average of the tails for the gap risk add-on charge. The loss distribution, which is a function of the probability of price jumps and correlations, is built from over 500,000 Monte Carlo simulations where correlated jumps are applied to the underlying fund NAVs. The probabilities of the jumps are calibrated from the prices of traded gap options and out-of-the-money S&P puts. Correlations are based on historical analysis of underlying fund strategies' NAVs based on the Hedge Fund Research ("HFR") index.²⁷ At year end 2005, Lehman held \$132 million (or 2.55% of notional) in capital against \$5.2 billion in structured fund products. This equates to a risk weighting of 32%,²⁸ which falls between the 20% "AA" risk weighting and the 50% "A" risk weighting prescribed for corporate claims under Basel II.

With respect to counterparty credit risk, Lehman holds zero capital. The only structured fund product that generates counterparty credit risk is the portable alpha. As stated previously, the TRS within the portable alpha product is referenced to a standard equity or fixed income index, and as such, the firm uses the same counterparty credit risk model that it uses for all OTC derivative products. Since this model does not account for jumps and because the TRS is substantially over collateralized, the resulting capital charge is zero.

At Bear Stearns, structured fund products generally include a charge based on four time 10-day VaR plus an add-on for gap risk. The gap risk add-on is calculated based on a stress test derived from the firm's Equity Capital Model ("ECM") that is based on the worst return period for hedge funds (i.e., the 2nd half of 1998). The primary variable in the ECM is the "99% loss level," which is set for various basket sizes and forms the basis for the ECM base case trade. The base case trade generates a 5% add-on from a trade structure that approximates an "AA" to "A" risk profile. The 5% base case charge is applied to notional amounts, and equates to a risk weight of 62.5% (5% add-on divided by an 8% capital charge) versus 20% to 50% risk weight prescribed by Basel for "AA" to "A" rated risk. The base case trade uses the following characteristics: (1) quarterly liquidity; (2) day-1 customer equity equal to the 99% loss level (from the worst historical period (2nd half of 1998) plus 10% and (3) an unwind trigger at the 99% loss level (which gives the firm the right to break the trade at this level).

Bear Stearns uses the base case add-on of 5% as a starting point, and then adjusts the capital charge up or down for actual trades depending on how much the trade deviates from the base

²⁷ Historical data includes the LTCM crises (i.e., the period of market dislocation that ensued in September and October of 1998).

²⁸ Since we know that capital held is \$132 million (or 2.55% of notional) and the capital charge is 8% of risk weighted assets; we calculated risk weighted assets by dividing the 2.55% by the 8% capital charge.

case assumptions. At year end 2005, Bear Stearns' add-on was approximately 4% resulting in a \$201 million gap risk add-on, which implies a risk weight of 50% ($50\% \times 8\% = 4\%$). Most of Bear's structured funds trades are subject to gap risk, with the exception of the pass-through certificates that are fully funded at inception and the limited amount of total return swaps that are deemed to be on a secured basis with a creditworthy counterparty. The pass-through certificates capital charge is solely VaR based and the TRS recourse trades is VaR based plus counterparty credit risk charge. Both of these generate little capital.

At Merrill Lynch, the firm uses a Basel I type approach where they calculate risk-weighted asset values for specific risk and derivative counterparty risk, and then apply a 10% capital charge to the total risk-weighted amount. For specific risk, Merrill uses 100% risk weighting for all "on-balance sheet" structured fund products. It is important to note that Merrill's "on-balance sheet" amount is the NAV of the underlying hedge fund shares, not the notional balance of the structured products themselves. This appears reasonable given the high ratio of hedge fund NAV to notional balance. OPSRA suggested that going forward it might make more sense to use the greater of the notional balance on structured products or the NAV on hedges, although this may be a mute point given the fact that the firm holds a comparatively high level of capital compared to its peers.

The firm also calculates derivative counterparty risk, on hedges, per Regulation Y. At year end 2005, Merrill Lynch held \$186 million in capital against \$1.9 billion in notional for structured hedge fund products. The firm's capital add-on percentage is by far the most conservative capital charge for any of the CSE firms—10%. This equates to a risk weighting of 100% (based on the 10% capital charge being applied) but, for comparison purposes, would equal 125% risk weighting if based on the 8% capital charge used to compare the other firms.