Evaluating Sources of Efficient and Inexpensive Beta

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LEHMAN BROTHERS

Building a portable alpha program

What do you need to build a portable alpha program?

- Eliminate beta (if any) from alpha generator
- Gain new beta
- Use as little cash as possible in beta replications
- Establish formula for rebalancing alpha and beta allocation
- Provide for differences in liquidity of alpha and beta

The alpha and beta selection should be done jointly

- Unless the alpha and beta sources are "manufactured" in the same place, the alpha source will typically consume all of the cash,
  - therefore, the beta will need to be synthetic
- Many "alpha" sources are not "pure", therefore to avoid leveraged exposure, a beta should be selected that has lowest possible correlation with alpha.
- The volatility of both alpha and beta will affect the frequency and amount of rebalancings, affecting the cost of the portable alpha strategy.

The choice of beta will affect and be affected by the Portable Alpha structure

- Do you..
  - Want to manage Portable Alpha strategy in-house?
  - Want to select an asset manager to run the entire strategy?
  - Want to execute the alpha and beta strategies separately?
  - Want the ability to select multiple alpha sources?
  - Want the ability to select multiple beta sources?
  - Have the authority to use derivatives, execute ISDAs?
  - Want to use F-o-Fs, direct investments or long-only managers as alpha source?

Beta Alternatives

- **Fixed Income**:
  - Lehman U.S. Aggregate, Government/Credit, Japanese Aggregate, etc.
  - RBI baskets designed to track the return of the following indices: U.S. Aggregate, Global Aggregate, Global Aggregate ex USD, Euro Aggregate, PanEuro, Euro Corporate, JPY Aggregate (see page 28)
- **Equity**:
  - Standard & Poor's 500 Index
  - NASDAQ
  - Russell 2000 & Russell 1000
  - EURO STOXX
- **Commodities:**
  - Lehman Brothers Commodity Index
  - Goldman Sachs Commodity Index
  - Dow Jones-AIG Commodity Index

Evaluating where to implement a Portable Alpha strategy

- Most Fixed Income managers underperform Lehman Brothers US Aggregate Index.
- Equity managers have better opportunity to add alpha in a long only strategy.

	EQUITY*	FIXED INCOME**
	Benchmark Index	
	S&P	Lehman Agg
10 Year Median Manager	9.32%	6.39%
- Index	8.31%	6.22%
- Assumed Fees	50 bps	15 bps
Median Active Alpha	**51 bps**	**2 bps**
10 Year 25th Percentile	10.85%	6.58%
- Index	8.31%	6.22%
- Assumed Fees	50 bps	15 bps
25th Percentile Active Alpha	**204 bps**	**21 bps**

Source: Evestment Alliance through 6/30/06

* *Equity (290 Active Managers)*
** *Fixed Income (245 Active Managers)*

Fixed Income as a Beta Source

Why use fixed income as beta source

- **Active fixed income managers have not generated high alpha**:
  - Fixed income markets are too efficient.
  - Most investment mandates too restrictive (e.g. credit quality, leverage usage, shorting) to allow for high alphas.
- **Plan sponsors need more fixed income exposure**:
  - Regulatory and accounting reform is encouraging plan sponsors to increase fixed income exposure
  - Porting alpha to fixed income allows sponsors to reduce funding status volatility without reducing expected return
- **Fixed income markets have less volatility than equities**
  - Lehman Agg historical vol. 3.8% vs. S&P500 15%
  - Lower volatility means less rebalancings

So why have portable alpha strategies to fixed income not been more popular?

- Because low cost, liquid betas for fixed income indices have not been available until now!

How to obtain (or eliminate) fixed income beta

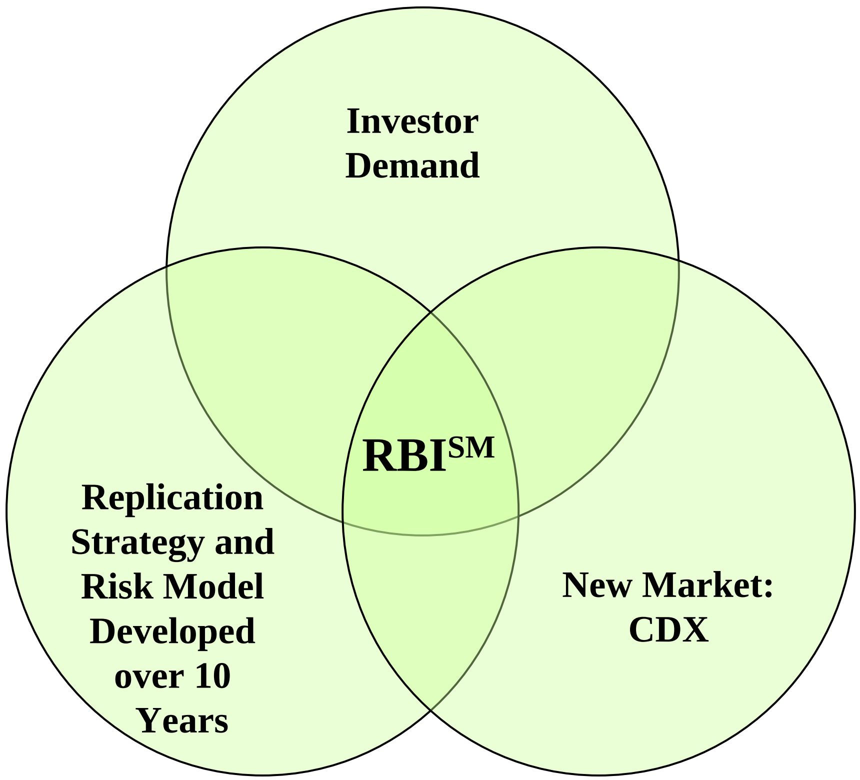
Strategy	Pros	Cons
Cash bond portfolio	Very low tracking error	Synthetic alpha is expensive
Exchange-traded fund	Transparent Low maintenance	Uses cash Few index choices Limited liquidity
Total return swap	No tracking error Low maintenance	Expensive Few index choices Limited liquidity and tenor
Derivatives replication	**Low tracking error** **Very flexible**	**High maintenance (monthly)***

* Rebalancing handled by Lehman Brothers as part of turnkey solution

Rationale for the Creation of the RBI℠ Basket

Investors are demanding: **We Want Agg!**

This is the perfect environment for the creation of RBI℠ (Replicating Bond Index) Baskets



RBI℠ Basket Description

What are RBI Baskets?

- Replicating Bond Index (RBI) baskets are portfolios of derivative instruments designed to track a bond index.
- The basket is reconstituted each month, using a mechanistic algorithm, to match, as closely as possible, the term structure and spread exposures of the relevant Lehman index.
- RBI baskets can be created on any Lehman Index or custom index. The broader the Lehman Index desired to be replicated, the lower the likely tracking error.
- RBI baskets can be used as the reference index for total return index swaps.

RBI is a service mark of Lehman Brothers, patent pending

Replicating U.S. Bond indices with derivative instruments

Instruments	Pros	Cons
◆ Treasury Futures	Liquidity, Cost	Margin, tracking error, less maturity choices
◆ Interest-rate Swaps	Wide maturity choice, Good for non-Treas.	Collateral, ISDAs
◆ TBAs (for MBS)	Very good tracking, Low admin. cost	Requires monthly rolls
◆ CDX + I. rate swaps (for Credit)	Raises carry return Very liquid	Collateral, ISDAs, not perfect match for index

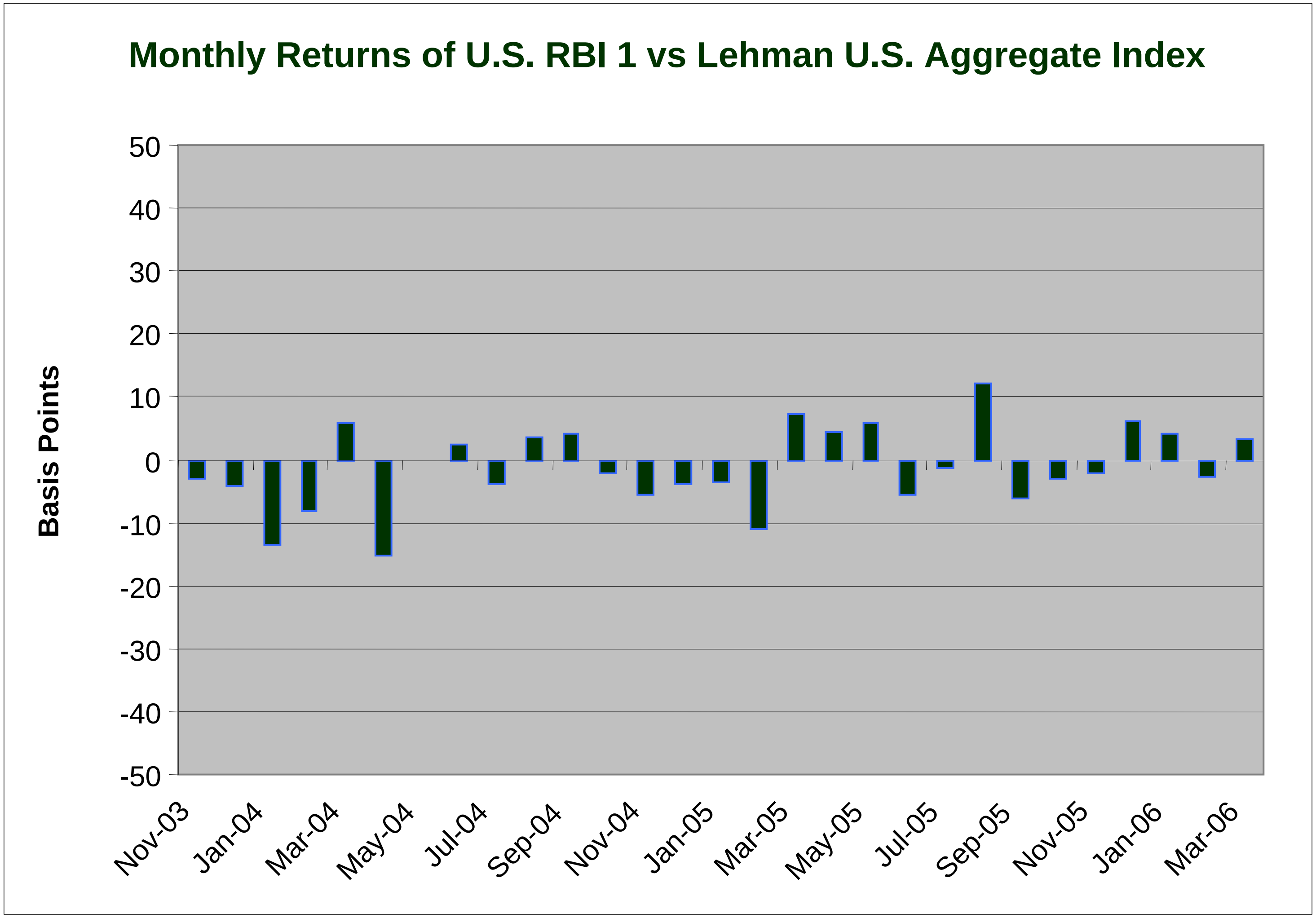
Replication Technique

- Select combinations of replicating instruments
- Match index exposures to replicating instrument exposures (requires high quality analytics)…e.g. using key-rate durations
- Choose rebalancing frequency

For details, see "Replicating the Lehman Brothers Aggregate Bond Index with Liquid Instruments", Lehman Brothers 2004

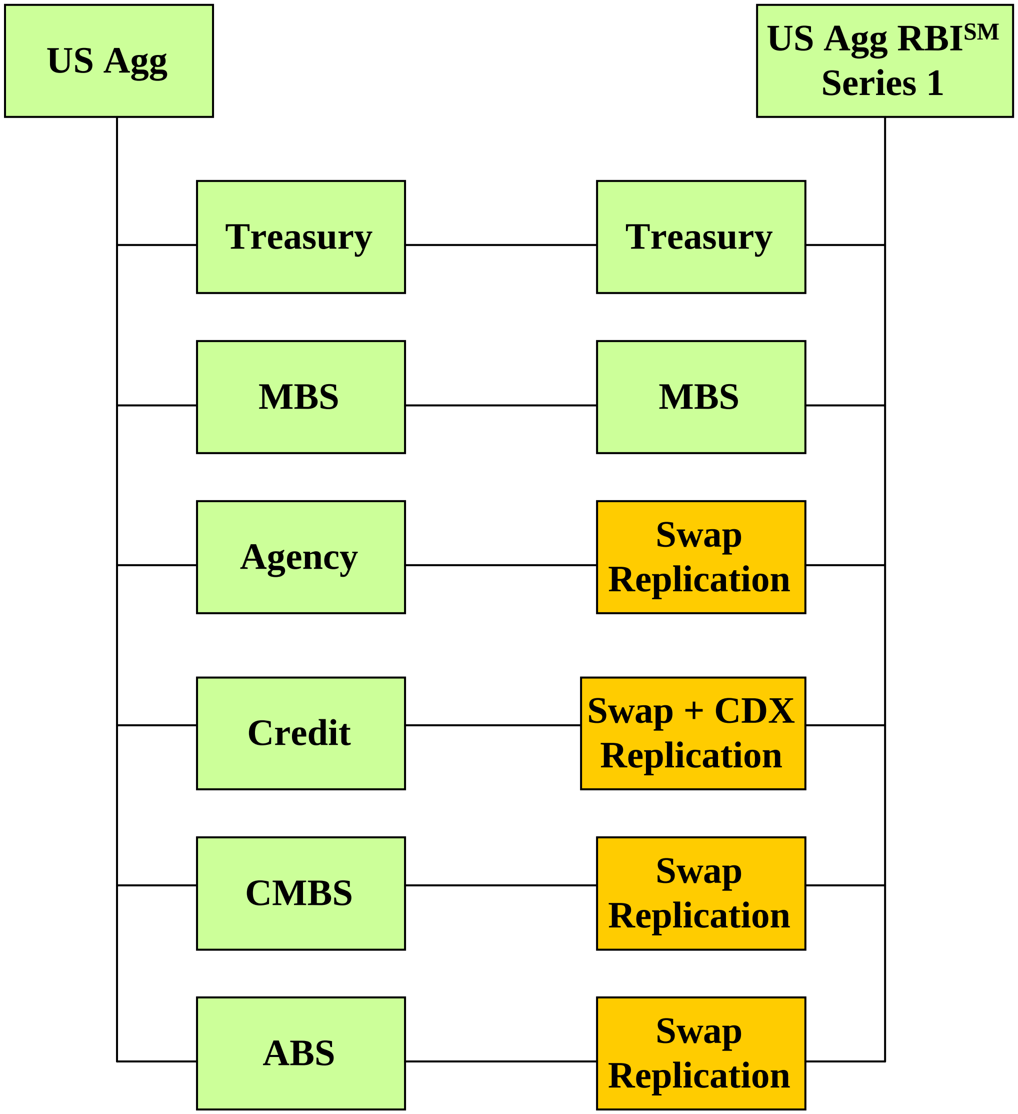
Comparing the RBI basket to the Lehman Agg

Realized monthly tracking errors have been minimal



Average: -1.2 bps **Standard Deviation: 6.4 bps**

U.S. Aggregate RBI^{SM} Basket Series



- RBI^{SM} is rule based
- RBI^{SM} basket rebalanced monthly
- Return and statistical information published daily on LehmanLive
- Series 2 does not include the CDX
- Treasury and MBS Indices are not replicated. They represent 60% of the Agg Index

Return Comparison for the RBI Platform

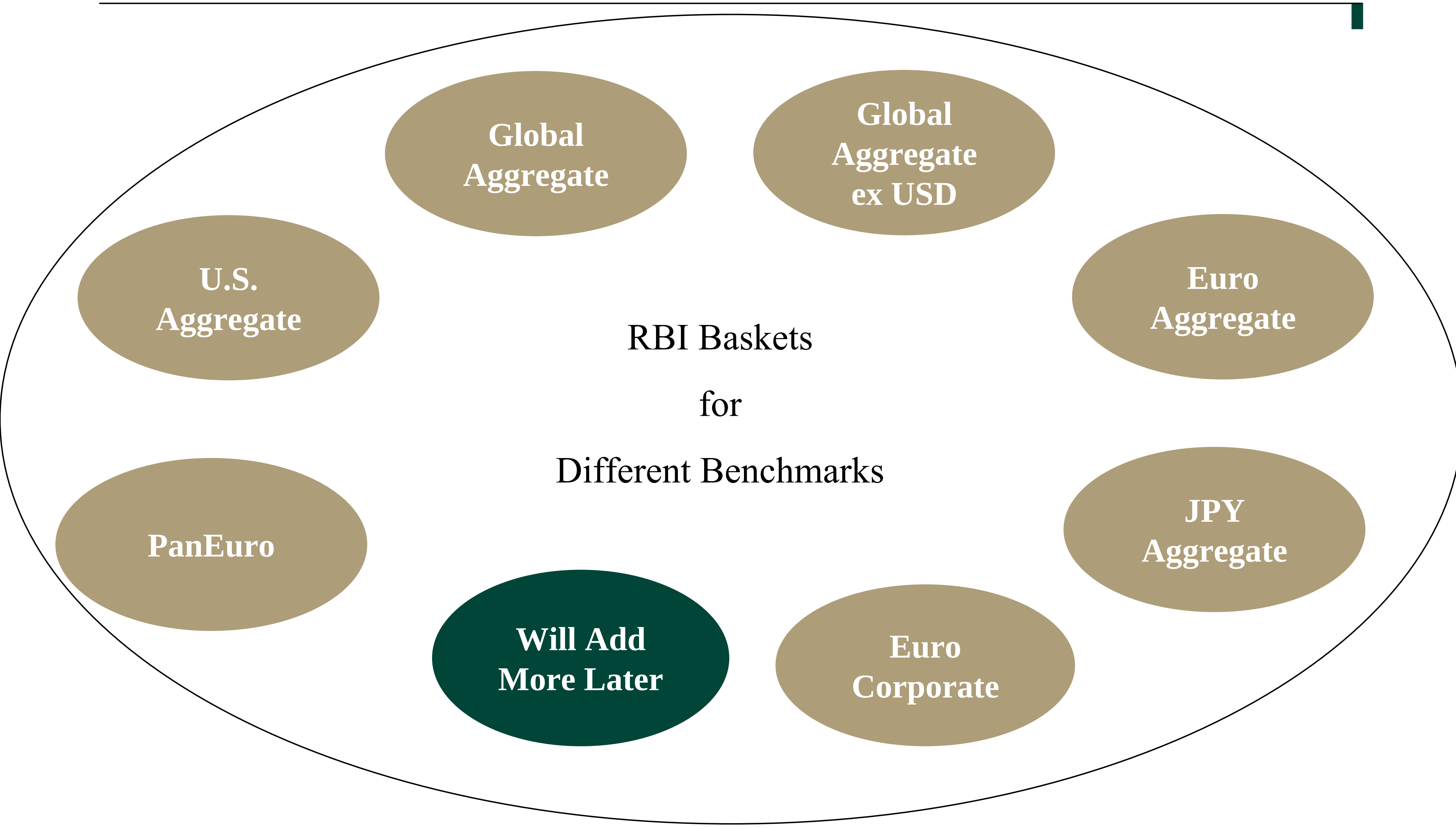
From April 2004 to June 2006, in bps per month

Replicating Basket	Average Outperformance (bp per month)	Tracking Error Volatility (bp per month)
U.S. Aggregate RBI 1	-0.44	6.02
Global Aggregate RBI 1	-0.92	4.18
Japanese Aggregate RBI 1	1.22	4.71
Euro Aggregate RBI 1*	-2.50	5.58

* Euro Aggregate data from June 2005

* Tracking Error Volatility is the most appropriate metric to measure the performance of replication strategies, as history is a much better guide for predicting volatility than for predicting returns. For a more detailed discussion on this topic, see "Replicating the Lehman Brothers Aggregate Bond Index with Liquid Instruments," available on LehmanLive.

Different RBI Baskets for Different Benchmarks



Have been completed. Other RBI baskets will be completed within the coming months.

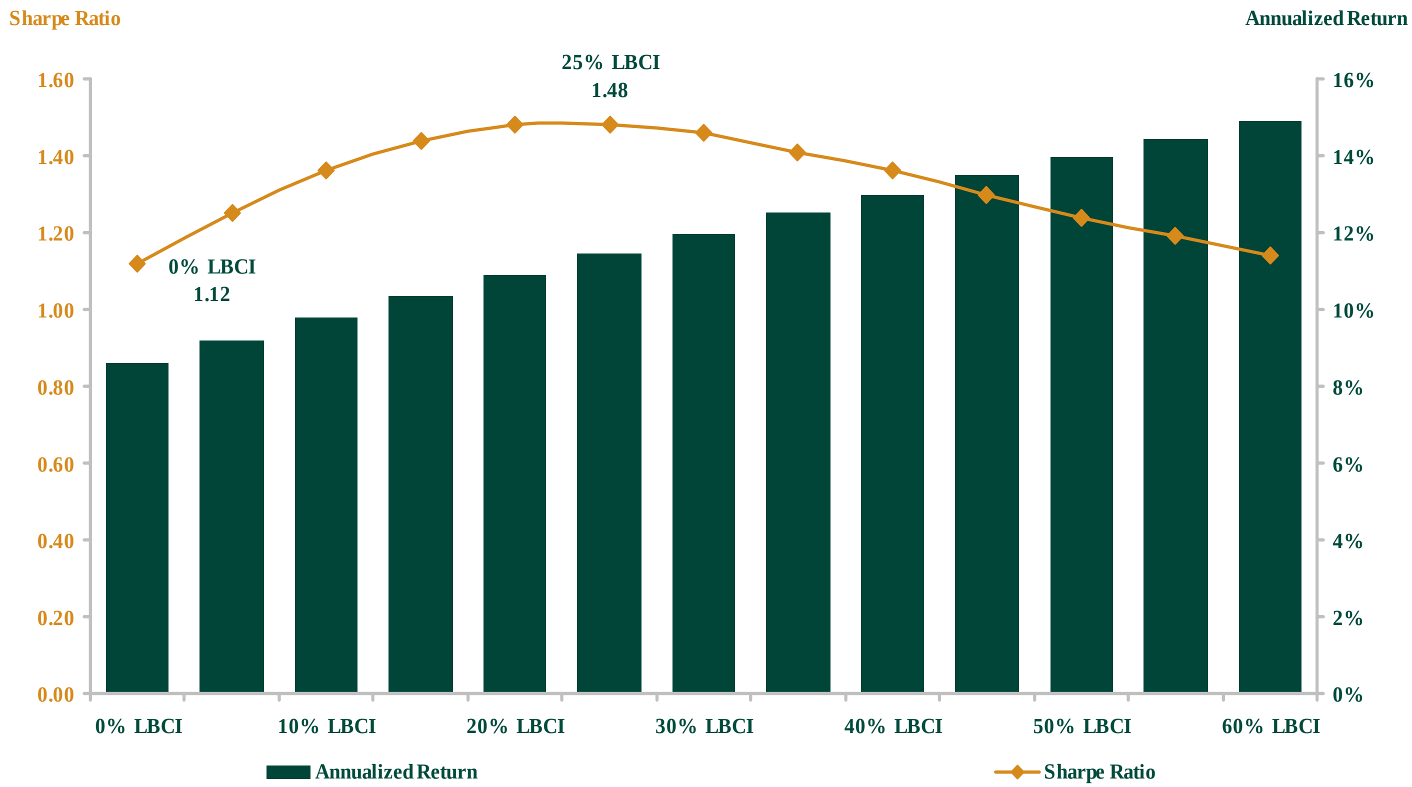
Commodities as a Beta Source

Risk-adjusted Returns Make Case for Commodities

Commodity returns have zero or negative correlation with those of other major asset classes. As a result, a commodity index can improve risk-adjusted returns for a diversified portfolio, and make them a perfect beta for a portable alpha strategy.

LBCI increases the risk-adjusted return of a 60/40 stock/bond portfolio. With an optimal portfolio of 25% LBCI, 45% S&P 500 and 30% US Agg, an investor can achieve an annualized return of 11.44%.

Adding LBCI to a 60/40 Stock/Bond Portfolio (12/31/02 – 8/8/06)



Note: Assumptions – Stock, bond and commodity returns and volatilities in hypothetical portfolio assumed to be those of SPX, LBAG and LBCI, respectively. Statistics are for the period of December 31, 2002 to August 8, 2006. Portfolios weights are rest on a a daily basis.

Several Ways to Obtain Commodity Exposure

Amongst several alternatives, index-based investments stand out as the most efficient.

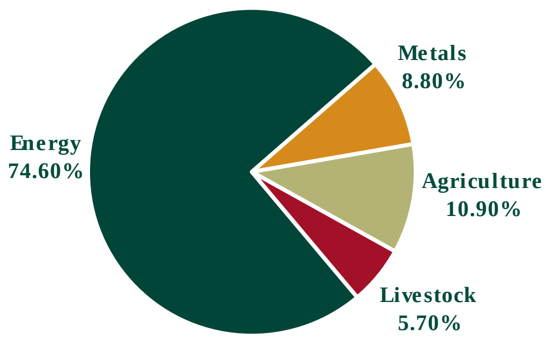
Alternatives	Benefits	Costs and Risks
Physical Ownership	◆ Direct control of asset ◆ Best spot performance tracking strategy ◆ Direct upside in case of supply disruption	◆ Storage costs ◆ Other carrying costs ◆ Transportation costs
Commodity-Sensitive Equities	◆ Liquidity ◆ Dividends ◆ Tax efficiency	◆ Mismanagement ◆ Equities market correlation
Commodity-Sensitive Currencies	◆ Macro effects of high commodities prices ◆ Liquidity	◆ Monetary regime
Hedge Funds, CTAs, CPOs	◆ Active management	◆ Black box ◆ High fees
Futures	◆ Liquidity ◆ Leverage	◆ Volatility ◆ Roll management ◆ Risk of total loss
Index-Based Investments	◆ Diversification ◆ Equity-like returns & volatility ◆ Negative correlation with other major asset classes ◆ Basket combinations ◆ Total return delivery alternatives ◆ Controllable leverage	◆ Fees

Goldman Sachs Commodity Index (GSCI)

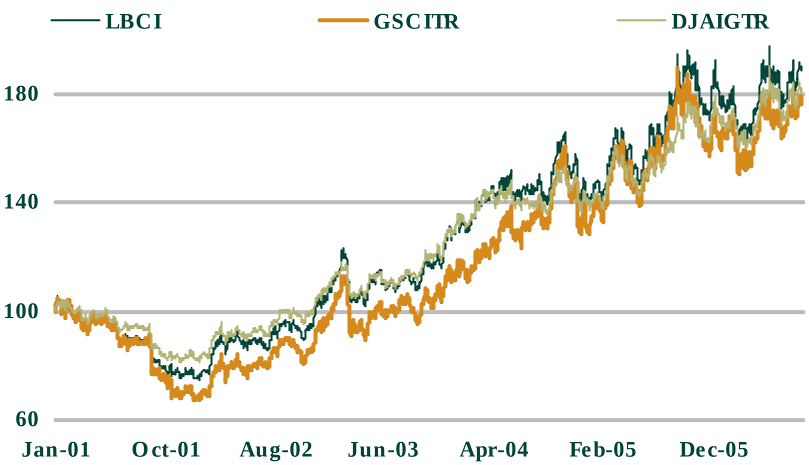
Production-based weighting scheme emphasizes the energy sector.

- The quantity of each commodity in the index is determined annually by the Policy Committee. It is based on the average quantity of world production in the last five years of available data.
- Individual components are screened by liquidity for inclusion.
- While the index is comprised of 24 different commodities, energy consistently dominates all other commodity groups.

Sector Weights as of 7/1/06[1]



Index Performance[2]



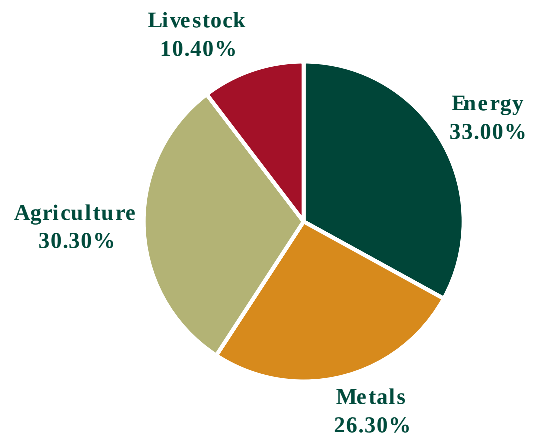
1. *Goldman Sachs.*
2. *Statistics are for the period of January 2, 2001 to August 8, 2006.*

Dow Jones — AIG Commodity Index (DJAIG℠)

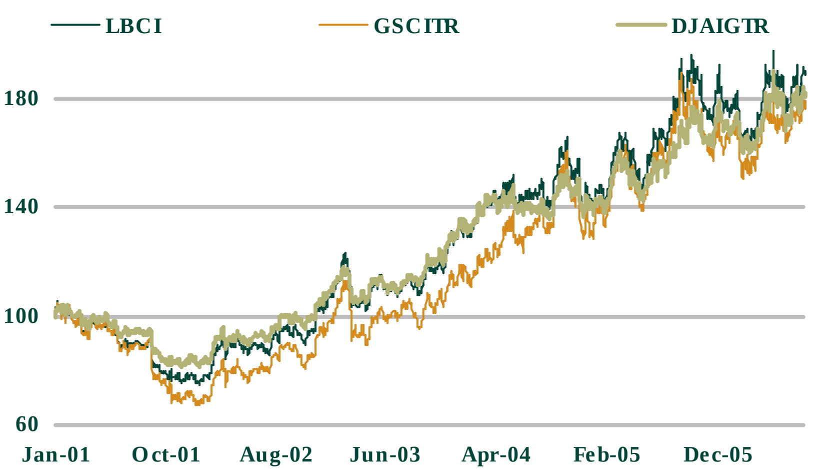
Balanced allocation is achieved by constraining sector weights.

- The DJAIG Index was designed to address the high energy concentration of the GSCI.
- Weights are determined annually by the Oversight Committee, which consists of leading academics, financial market participants and employees of AIG and Dow Jones. The Oversight Committee relies on liquidity data, along with dollar-adjusted production data in determining the relative quantities of the included commodities.
- Weights are subject to constraints to ensure that no group of commodities exceeds 33% of the index or constitutes less than 2% of the index.

Sector Weights as of 7/1/06[1]



Index Performance[2]

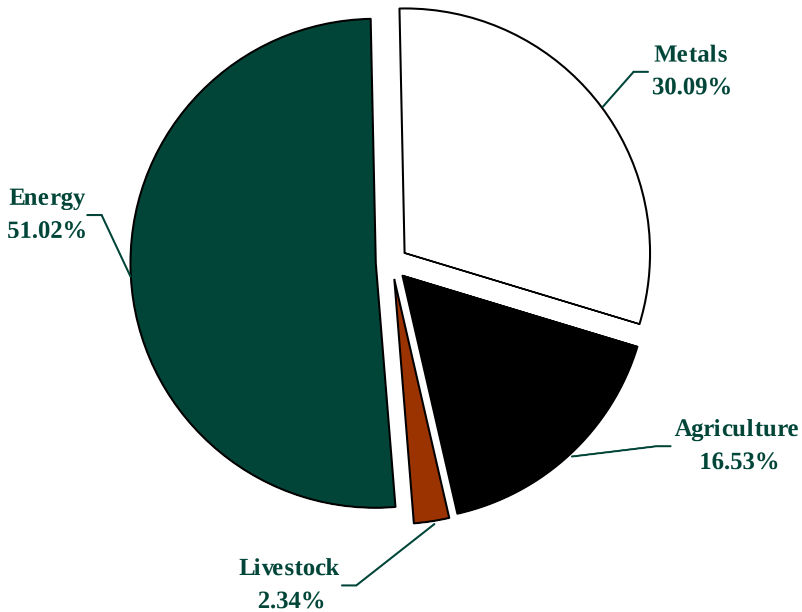


1. *Dow Jones AIG.*
2. *Statistics are for the period of January 2, 2001 to August 8, 2006.*

Lehman Brothers Commodity Index (LBCI)

Launched on July 1, 2006, the Lehman Brothers Commodity Index (LBCI) is based on the total return of futures contracts on energy, metals, agriculture and livestock commodities.

Sector Weights as of 7/1/06



Sub-Sector Weights

Sector	Sub-Sector	Commodity	Exchange	% LBCI
Energy				**51.02%**
		Crude Oil	NYMEX	27.48%
		Natural Gas	NYMEX	7.98%
		Unleaded Gas (RBOB)	NYMEX	8.13%
		Heating Oil	NYMEX	7.43%
Metals				**30.09%**
	Industrial	Aluminum	LME	4.54%
		Copper	LME	10.50%
		Nickel	LME	2.23%
		Zinc	LME	2.83%
	Precious	Gold	COMEX	7.65%
		Silver	COMEX	2.34%
Agriculture				**16.53%**
	Grains	Soybeans	CBOT	5.76%
		Corn	CBOT	3.24%
		Soybean Meal	CBOT	1.48%
		Wheat	CBOT	1.73%
		Soybean Oil	CBOT	1.18%
	Softs	Coffee	NYBOT	1.16%
		Cotton	NYBOT	0.95%
		Sugar	NYBOT	1.03%
Livestock				**2.34%**
		Live Cattle	CME	1.43%
		Lean Hogs	CME	0.91%

LBCI Is More Objective Than Other Indices

LBCI is an objective, rules-based index of commodities futures that uses liquidity as the primary criterion for commodity selection and weighting.

LBCI Terms	
Contract Eligibility	◆ USD-denominated futures contracts only ◆ 3-year trailing average dollar value of contracts traded daily (DVCT) > $250MM ($1B for industrial LME metals) ◆ Maintenance DVCT $200MM ($800MM for industrial LME metals)
Weight Determination	◆ Liquidity Factor (LF) = DVCT / Price on second day of year ◆ $\text{Weight}_i = \text{LF}_i \times \text{Price}_i / \Sigma (\text{LF}_i \times \text{Price}_i)$ ◆ Resets yearly in January based on November 30th DVTC
Roll Mechanics	◆ 20% of prompt contract rolled to next-nearest contract at end of fifth business day of prompt contract expiry month[1] ◆ 20% of prompt contract rolled each business day thereafter
Other Terms	◆ NYMEX operational calendar ◆ "External factor" contract substitution with advance notice

1. *The following contracts have been deemed illiquid and are thus excluded from the roll process: GCV, SIF, LHK, LCK, LCN, SQ, SU, SMV, SBQ, SOV, SOQ, CTV. When any of these contracts is the next nearest in a roll process, it is skipped and the next month's contract is used.*

Major Indices Comparison

LBCI differentiates itself with an objective, liquidity-based weighting scheme.

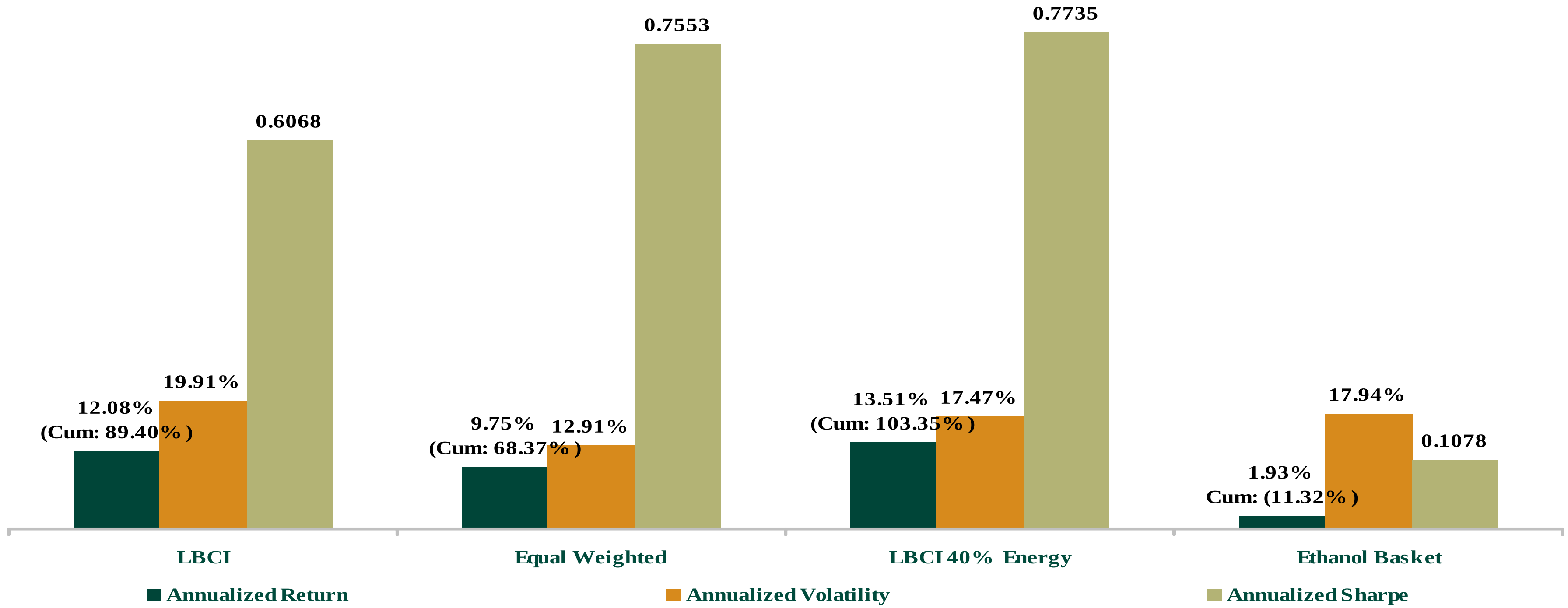
Summary Characteristics

	LBCI	GSCI	DJAIG
Commodity Inclusion and Weighting Criteria	◆ Liquidity ◆ Pure rules-based approach	◆ Policy Committee ◆ Determines the weights based on average quantity of world production in the last five years	◆ Oversight Committee ◆ Relies on liquidity data, along with dollar-adjusted production data
Data History	◆ 2001	◆ 1970	◆ 1991
Diversification	◆ Energy: 51%	◆ Energy: 75%	◆ Cap at 33% on any group
Number of Commodity Futures Included	◆ 20	◆ 24	◆ 19

LBCI Customization

- LBCI offers customization capabilities for investors with specific views on commodity sub-indices.
- Lehman Brothers can customize each sub-index weight at time zero, after which the weights can either be dynamically restructured based on liquidity or periodically reset to the original weights.
- Each LBCI composition offers a different historical risk-adjusted return and can thus serve a different investment objective.
- This flexibility in the index will allow investors to continually tailor their LBCI investments based on their changing outlooks and risk appetites.

LBCI Composition Possibilities

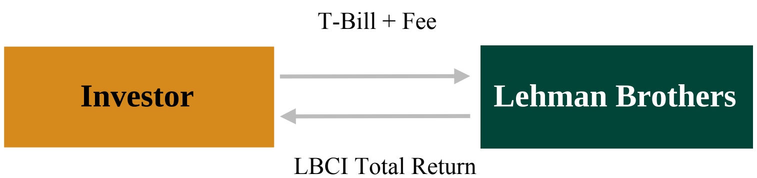


Statistics are for the period of January 2, 2001 to August 8, 2006. Portfolios weights are rest on a a daily basis.

Index Returns Are Deliverable in a Variety of Structures

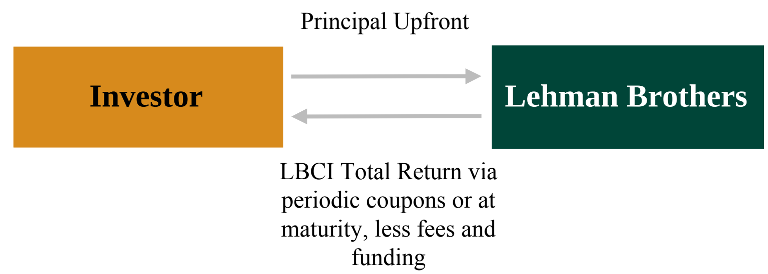
Total Return Swap

Client pays the T-Bill yield plus a fee and receives the LBCI total return. Reset dates can be monthly, quarterly, annually or any customized schedule.



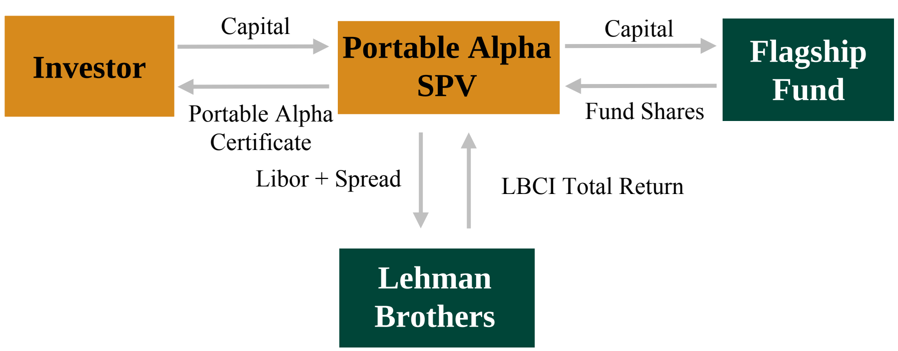
Vanilla Structured Note

Client purchases a non-principal-protected note with a return equal to the LBCI total return, less fees and funding.



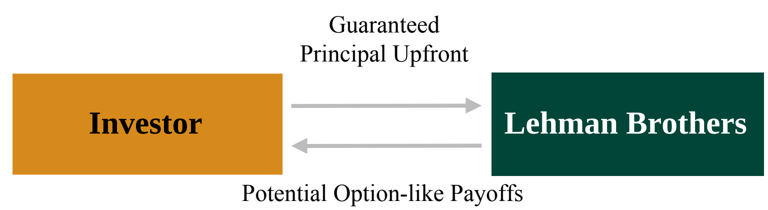
Portable Alpha

Client uses LBCI as beta source, porting alpha from a Flagship Fund.



Exotic Structured Note

Client purchases a principal-protected note with option-like payoffs.



Equities as a beta source

Structuring the beta

Choices for implementing the structure

- Hire a single manager for alpha and beta
  - Pro: Usually lowest cost, sometimes beta is offered for free
  - Con: Many alpha providers do not offer beta

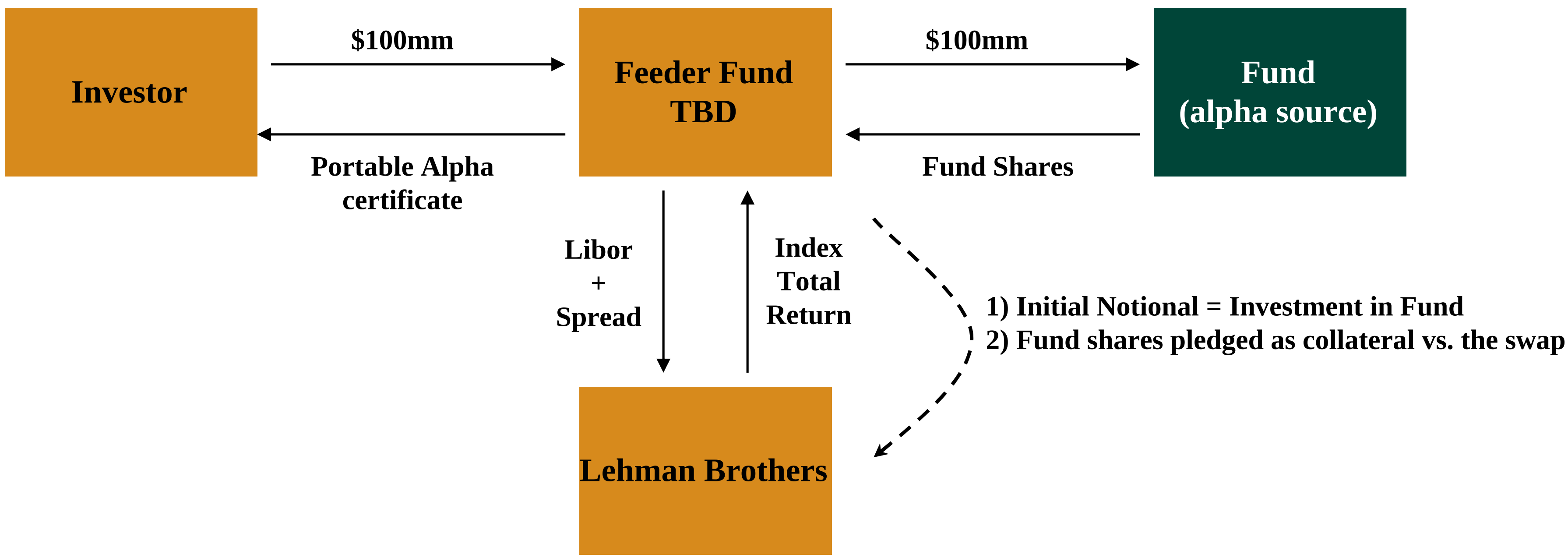
- Hire a separate manager for both
  - Pro: Most flexible strategy
  - Con:You pay for flexibility
  - Who is managing the alpha/beta rebalancing? May lead to performance shortfall

- Use a structured product
  - Pro: Flexible strategy, alpha/beta rebalancing is automatic
  - Con: More costly than hiring a single manager

Sample Structured Transaction

- Lehman Brothers creates a designated Portable Alpha Special Purpose Vehicle ("SPV")
- Investor purchases Portable Alpha Shares issued by the Portable Alpha SPV
  - The Portable Alpha SPV uses the proceeds received from Investors to purchase shares of the Fund (e.g. alpha)
  - Simultaneously the Portable Alpha SPV enters into a total return swap with Lehman linked to the Index (e.g. beta)
    - The notional amount of the total return swap will be equal to the amount invested in the Fund
    - The Portable Alpha SPV will pledge its shares of the Fund as collateral under a total return swap agreement
- Investor's return on the Portable Alpha Shares equals

  Fund Return + Index Return – Financing Charge on the Total Return Swap



Benefits to Structured Solution

Combining Beta and Alpha in one Efficient Structure

- No extra collateral required to be posted
  - Fund shares used as collateral against the swap
  - Achieve 100% participation in both Alpha and Beta when trade commences

- Built-in financing
  - If Beta declines, structure allows for delayed payment on swap mark to market
  - If Beta increases, alpha is increased immediately on swap reset date

- Adjustments made automatically to keep Alpha and Beta in proper proportion
  - No bid/offer on adjustments to swap notional

- Lock-in pricing for duration of trade. Avoids market risk associated with shorter maturity swaps

- No ISDA required on the individual investor level

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