What are Derivatives?

- A claim whose cash flow and value are derived completely from one or more underlying assets, financial instruments or indices

- Usually involve one of the following:
  - Futures
  - Swaps
  - Options

- Traded on exchanges like CBOT and CME and off-exchange (OTC)

Example – Foreign Investor

- A foreign investor wants to quickly get exposure to the US real estate market to diversify into the US but doesn't have the time and expertise to identify individual properties and be sure he is also diversified within the US.
- They enter into a <u>long</u> position on a two year <u>forward</u> contract based on a national real estate index total return. The index is currently at 100. Forecasts for where the index will be in 2 yrs range from 105 to 115 (including cash yield).
- Investor agrees on a forward price of 105 that it will pay at the end of the two years in order to receive a payment based on the actual change in the index.
- The contract pays $500,000 times the index value.
- No cash payment is made today although a margin or bond may be required.

Payoff

- Suppose that at the end of the two years the index is 115 (upper end of forecast). The investor will receive

  $500,000 x (115 -105) = $5 million

- Suppose that at the end of the two years the index is 95 (bad forecast!).

  The investor will pay

  $500,000 x (95 -105) = -$5 million

Short Position
(This is the "counterparty", or opposite side: Every derivative trade requires both a "long" and "short" side to the trade…)

- The short position receives the opposite cash flows in the previous example, receiving $5 million when the index is 95 and paying $5 million when it is 115.

- The short might be a CMBS issuer who wants to hedge its warehouse risk, a hedge fund that believed the low end of the forecast was more likely or an investment manager seeking to "harvest alpha" (explained next).

Harvesting "Alpha"

A specialized RE asset mgt fund believes it can purchase properties that consistently out-perform the RE index (with same risk), based on their specialized expertise. They want to harvest the "alpha" from these excess returns whether the market is up or down (which they can't control, whereas they do control their "alpha"– difference betw their properties vs market).

They purchase $50 million in properties and sell (short) the forward contract on the index used in the previous example.

Results when values increase

- Suppose at the end of the two years the real estate fund's property portfolio increased in value by 20% (including income reinvested in fund). Suppose the total return index rose to 115 over the two years.

Appreciation on portfolio	$10,000,000
Loss on short futures	$5,000,000
Net gain	$5,000,000

Results when values decrease

- Suppose at the end of the two years the fund's property portfolio decreased in value by 2% (even including income earned).
- Suppose the index decreased to 95 over the two years (also including income).

Loss on portfolio	$1,000,000
Gain on short futures	$5,000,000
Net gain	$4,000,000

Conclusion

- Fund gains between $4 and $5 million whether the market increases or decreases.

- Gains in the down market even though its properties decreased in value, because its properties didn't do as bad as the index (positive "alpha").

Consider…

- How this "disarticulates" the performance of the "real estate experts" (the specialized fund managers whose expertise and performance are based on the relative performance of their physical properties – "bricks & mortar" – and/or on their specific property-level transaction execution, deal structuring, and RE asset mgt abilities) from the movements and forces and flows in the broader <u>financial</u> capital markets…

Long Position has Risk/Return similar to Holding Properties

- Return from RE index total return (similar to _diversified_ holdings of properties).

- If plan to buy physical properties over time, long position in derivative "locks in" current property market prices.

- Diversification benefit of RE in the mixed-asset portfolio – low correlation of real estate index with other asset classes

- Inflation hedge – to extent RE index is correlated with inflation

Short Position Reduces Exposure to Broad Property Mkt that is Beyond Control of Individuals

- "Hedges" RE Mkt exposure
- Like buying "property mkt risk insurance" – hence, a major <u>risk mgt</u> tool.
- Can also be used to effectively reduce relative holding (exposure) to real estate in a mixed-asset portfolio, without selling physical properties.

Types of Derivatives…

– Forwards

– Futures

– Swaps (& TRS)

– Structured Notes

– Options

– Credit Default Swaps (CDS)

Forwards

- – Traded OTC, customized contracts, private trades (secret)

- – Agree today to pay (or sell) underlying index at a specified certain price at a specified certain future date

- – No cash flow up front, no intermediate cash flows, cash settlement at maturity.

    (Like previous example)

Futures

- Exchange traded forward contracts, e.g., housing futures on the CME.

- Standardized contract specifications, margin or collateral (bonding) may be required.

- Open positions in futures are typically "marked to market" every day (net difference cash changes hands, or margin requirements are adjusted).
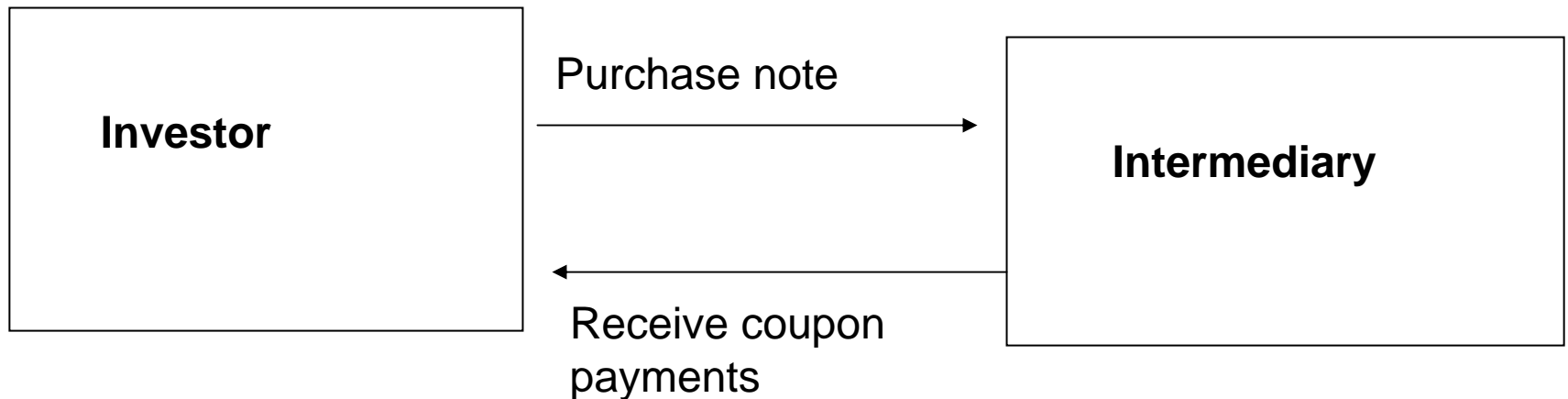
Swaps

– Swapping of exposure to certain risks

– Can be based on interest rates, currencies, equity indices, property indices, etc.

– Return swaps exchange the return on one portfolio, benchmark or index for another.

- London Interbank Offered Rate (LIBOR)
- FTSE 100, S&P 500 Indices
- NCREIF Property Index (NPI)
- To be available on other commercial real estate indices

– In RE derivatives, typically refers to a periodically cash-settled index return swap (e.g., RE index total return for LIBOR).

Total Return Swap (TRS)

- Some terminology confusion:
  - This may also be referred to simply as a "swap";
  - Often refers to only a capital return swap not actually a total return swap.
- TRS involve ongoing payments between the two parties to the contract
- Total return payer pays periodic index performance on the specified notional amount
- Total return payer pays funding rate on specified notional that is not linked to the index performance (fixed leg)
- Total return computed as Periodic Index Value / Prior Index Value -1
- Funding can be paid either fixed rate or floating rate, e.g., LIBOR + [ ]bp

Structured Note

- Like a swap but funded up front instead of being based on a notional dollar amount. No fixed leg.
- E.g., purchase structured note and receive the return on the index each quarter.
- Typical maturity would be 2 to 3 years.

```
┌─────────────────┐   Purchase note   ┌─────────────────┐
│                 │ ────────────────► │                 │
│    Investor     │                   │   Intermediary  │
│                 │ ◄──────────────── │                 │
└─────────────────┘   Receive coupon  └─────────────────┘
                      payments
```

Call option

- Gives the buyer the right <u>without obligation</u> to buy the index at a specific price (strike price) over (or at the end of) a certain period of time (expiration)

- Buyer pays the seller a premium or price for this option, price is the maximum loss (somewhat analogous to an insurance premium)

- Seller of option receives price paid for the option and must sell the underlying asset at the exercise price if the option is exercised. There is no limit to the losses the seller of the option may incur.
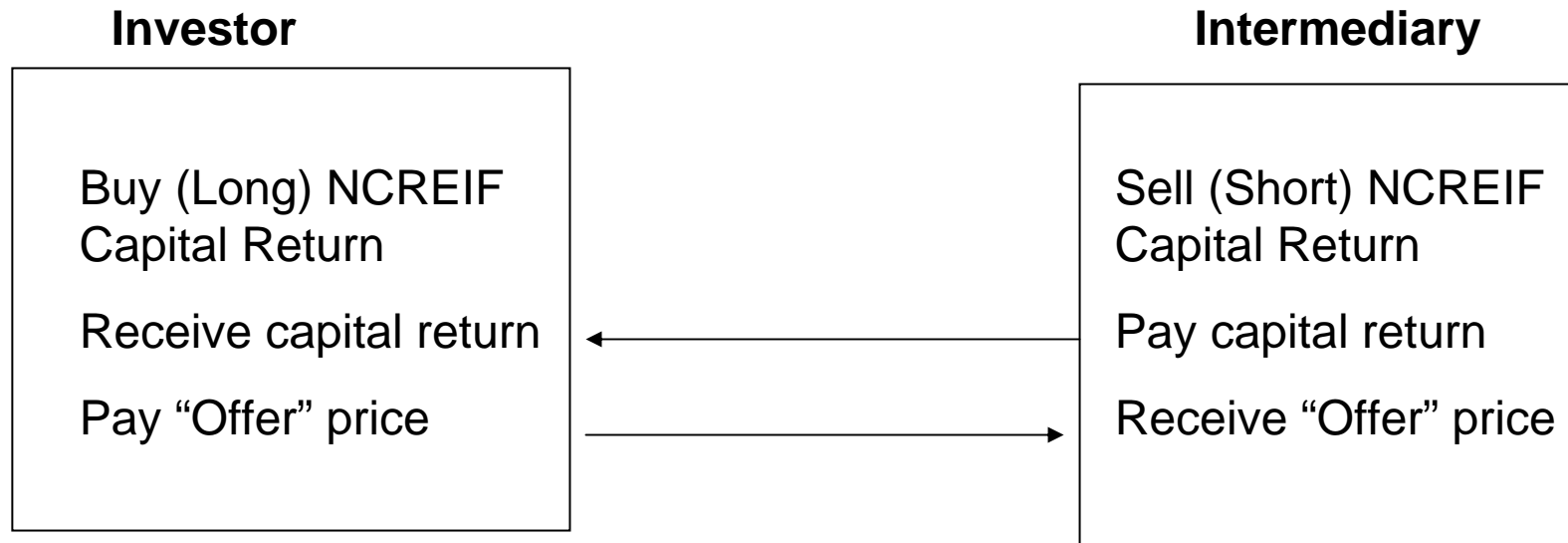
Put option

- Gives the buyer the right <u>without obligation</u> to sell the index at a specific price (strike price) over (or at the end of) a certain period of time (expiration)
- Buyer of put profits if asset falls below the strike price
- Price paid for the put option is again the maximum loss
- seller of the put option must sell the asset at the strike price regardless of how much the value of the asset has dropped

  Credit Default Swaps (CDS) are similar to this.

Example of Swap Usage

An open end fund has money to invest but has not yet identified properties they want to purchase. They believe that the capital return on the RE index will be stronger over the next two years than most market participants believe. They decide to take a long position in the index capital return as a swap where they receive the capital return and pay a "fixed leg" each quarter.

Investor Buys NCREIF Capital Return Derivative

Investor

Buy (Long) NCREIF Capital Return

Receive capital return

Pay "Offer" price

Intermediary

Sell (Short) NCREIF Capital Return

Pay capital return

Receive "Offer" price

NCREIF Spread Markets 6/13/06

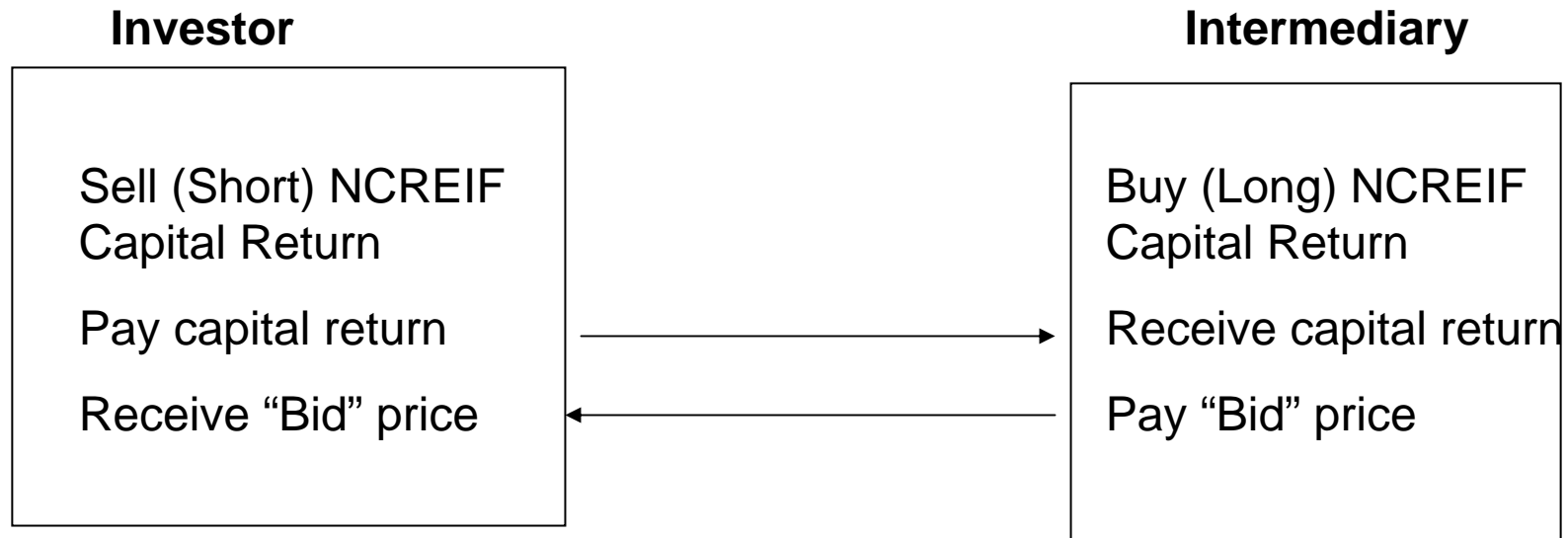| Index (2 Year Reference)	Bid / Offer (*)
NPI Capital Value Return	12.5 / 37.5

(*) Stated in bps/quarter

Payoff if long capital return

Year	Quarter	Capital Return	Fixed Leg	Difference
2006	3	2.00%	0.38%	1.63%
2006	4	3.03%	0.38%	2.66%

Long position would have received 1.63% in the 3rd quarter of 2006 and 2.66% in the fourth quarter. But what about next 6 quarters?

Investor Sells NCREIF Capital Return Derivative

Investor

Sell (Short) NCREIF Capital Return

Pay capital return

Receive "Bid" price

Intermediary

Buy (Long) NCREIF Capital Return

Receive capital return

Pay "Bid" price

NCREIF Spread Markets 6/13/06

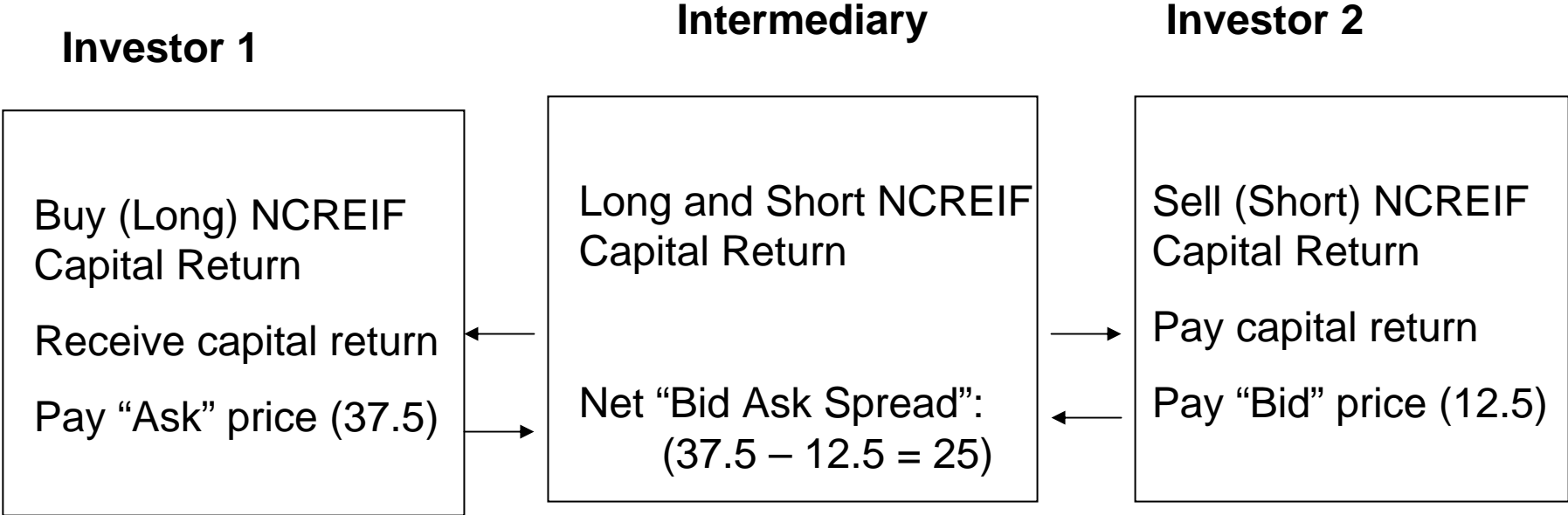| Index (2 Year Reference)	Bid / Offer (*)
NPI Capital Value Return	12.5 / 37.5

(*) Stated in bps/quarter

Short position

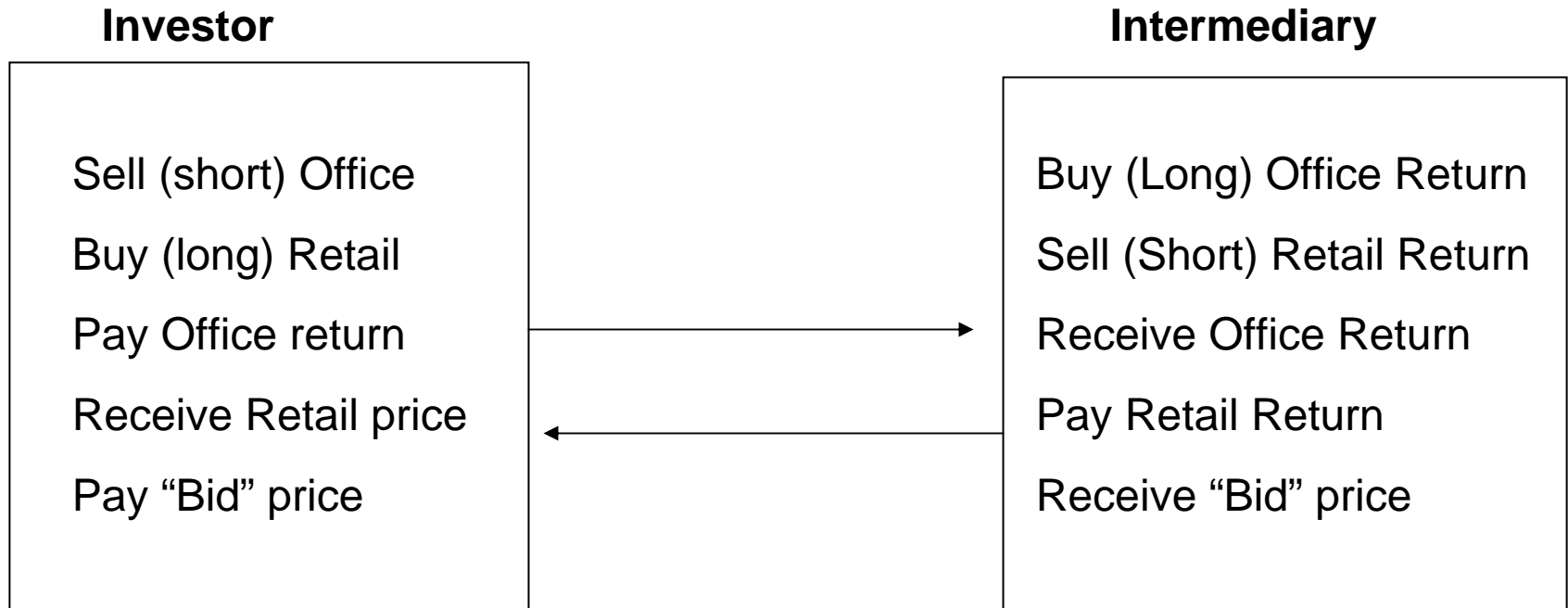| Year	Quarter	Capital Return	Fixed Leg	Difference
2006	3	2.00%	0.13%	-1.88%
2006	4	3.03%	0.13%	-2.91%

Short position would have paid 1.88% in the 3rd quarter of 2006 and 2.91% in the fourth quarter. Perhaps next 6 quarters will be better!

Intermediary is Long and Short NCREIF Capital Return Derivative – nets bid ask spread.

Investor 1

Intermediary

Investor 2

Buy (Long) NCREIF Capital Return

Receive capital return

Pay "Ask" price (37.5)

Long and Short NCREIF Capital Return

Net "Bid Ask Spread":
(37.5 – 12.5 = 25)

Sell (Short) NCREIF Capital Return

Pay capital return

Pay "Bid" price (12.5)

Property Type Swaps

Investor Swaps Office for Retail

Investor

Sell (short) Office

Buy (long) Retail

Pay Office return

Receive Retail price

Pay "Bid" price

Intermediary

Buy (Long) Office Return

Sell (Short) Retail Return

Receive Office Return

Pay Retail Return

Receive "Bid" price

NCREIF Spread Markets 6/13/06

Bid is for intermediary to buy office and sell retail.

Index (2 Year Reference)	Bid / Offer (*)
Office vs. Retail Total Return	35.0 / 70.0

(*) Stated in bps/quarter

Investor Purchases NCREIF Total Return (Income and Capital Return)

Investor

Buy (long) NCREIF Total Return

Receive total return

Pay Libor

Pay "Offer" price

Intermediary

Sell (Short) Total Return

Pay Total Return

Receive Libor

Receive "Offer" price
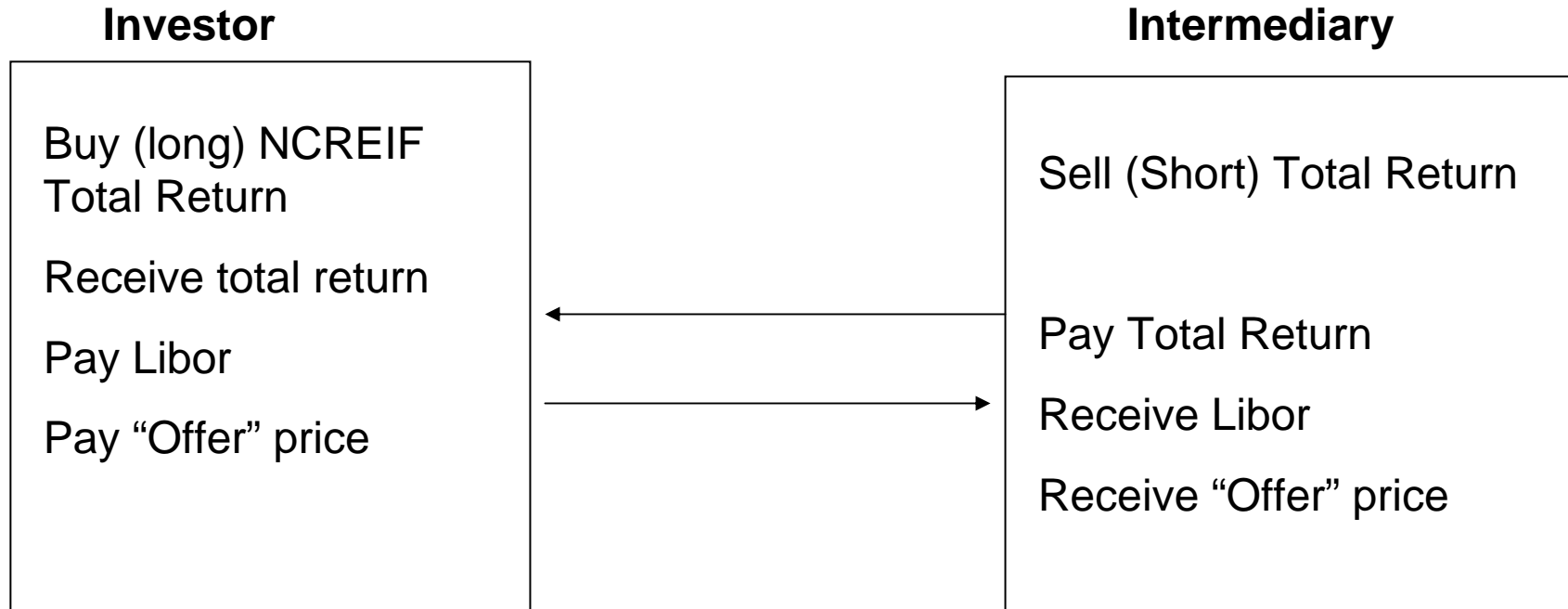
NCREIF Spread Markets 6/13/06

Index (2 Year Reference)	Bid / Offer (**)
NPI Total Return	L + 250 / L + 375

(**) Stated in bps/year ; L is 3-month Libor

Using Derivatives to Achieve Portfolio Target Real Estate Allocation

Use of long position in R.E. Index Swap to Achieve Effect of Target R.E. Allocation in Portfolio Risk & Return Performance: A 2-step process…

(1) Original Portfolio:
Equity: $1.5 B (50%)
Fixed Inc: $1.5 B (50%)
R.E.: $ 0 B (0%)
Total: $3.0 B (100%)

(2) Sell Stocks, Buy Riskless Bonds:
Equity: Δ – $500 M ➔ $1.0 B (33.3%)
Fixed Inc: Δ + $500 M ➔ $2.0 B (66.7%)
R.E.:   Δ 0   ➔ $ 0 B (0.0%)
Total: Δ 0   ➔ $3.0 B (100%)

Step 2: Earmark $1.0 Billion of Fixed Income Allocation to Riskless Bonds to Cover Fixed Spread Obligation in R.E. Index Swap.

No cash changes hands up front, but effect on portfolio risk & return is as if:

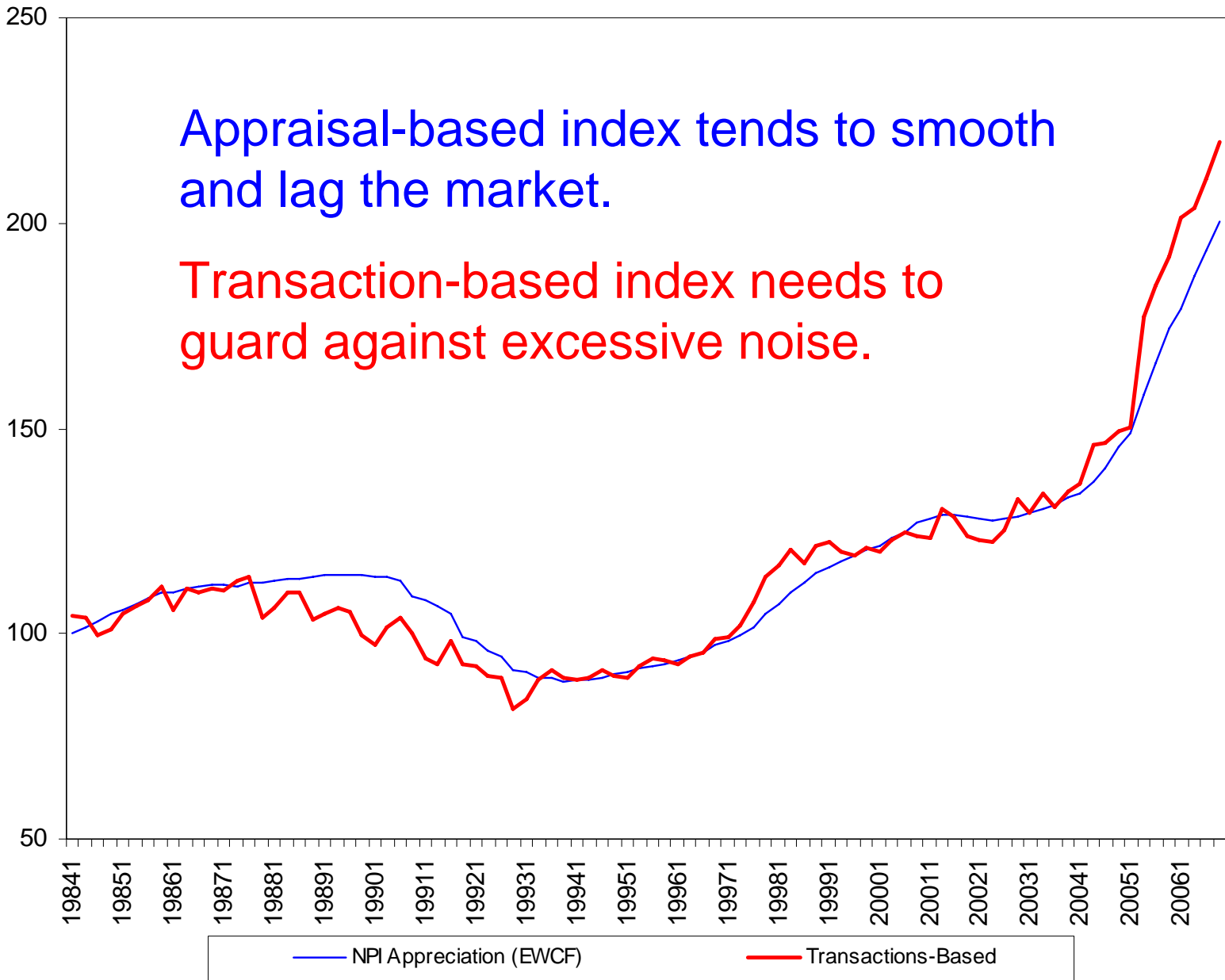| **(3) Long in Swap, Cover with Bonds ➔ New Portfolio:** |
| --- |
| Equity: $1.0 B, Δ 0   ➔ $1.0 B (33.3%) |
| Fixed Inc.: $2.0 B, Δ – $1.0 B   ➔ $1.0 B (33.3%) |
| R.E.: $ 0 B, Δ + $1.0 B   ➔ $1.0 B (33.3%) |
| Total: $3.0 B, Δ 0   ➔ $3.0 B (100%) |

Capital flows in first instance to debt market, helping keep interest rates low.

Real estate derivatives depend on good indexes of real estate market returns, to serve as the basis of the derivatives…

Two Major Types of R.E. Indexes

- Appraisal-based (e.g., NCREIF)
  - Track a particular sub-population in which ALL properties are appraised EVERY period (or almost)
  - Use the avg appraised value to represent V_t in the index return $A_t \approx V_t : r_t \approx (A_t - A_{t-1})/A_{t-1}$.
- Transaction Price-based (e.g., "repeat-sales")
  - Base index directly and purely on contemporaneous transaction prices of the _sample_ of properties that happens to sell each period
  - Use statistics/econometrics to _estimate_ population return (price change) each period.

NCREIF Index vs Transactions-Based Capital Value Index: 1984-2006, Quarterly

Appraisal-based index tends to smooth and lag the market.

Transaction-based index needs to guard against excessive noise.

Legend: NPI Appreciation (EWCF) — Transactions-Based

Source: Fisher, Geltner & Pollakowski (2006).

NCREIF Index vs Transactions-Based Capital Value Index: 1984-2006, Quarterly

Hedonic transactions-based index with noise filter:
➔ Most volatility is probably real…

1986 Tax Reform

'87 Stk Mkt Crash

1990-91 Recession

1992-93 Kimco Taubman IPOs

1997 REIT Boom

1998-99 Fin Crisis, REIT Bust

2001-02 Recession

2005-6 R.E. Boom

— NPI Appreciation (EWCF)   —— Transactions-Based
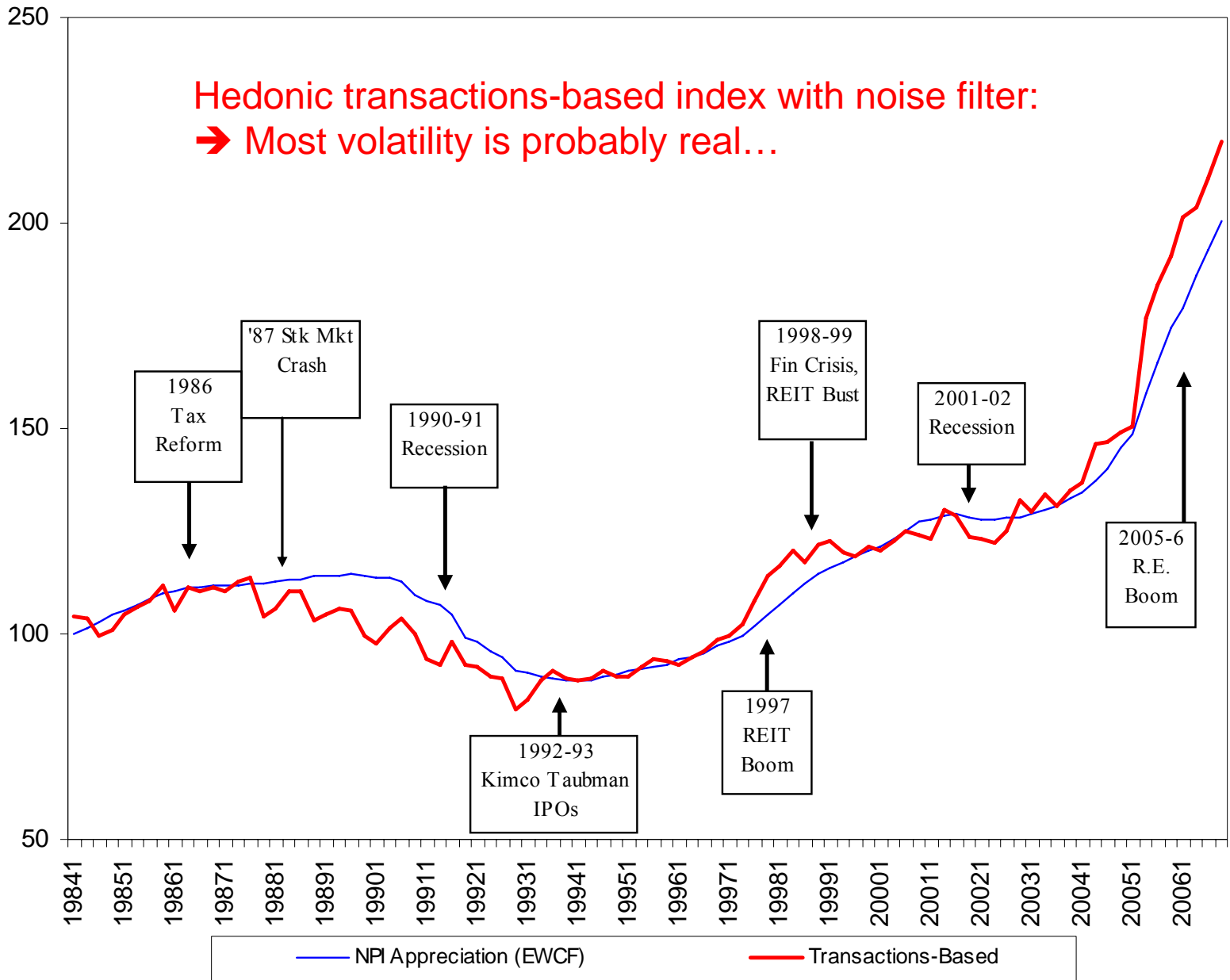
Source: Fisher, Geltner & Pollakowski (2006).

A different kind of transactions-based index: The RCA-based *Repeat-Sales* index…

RCA-based Repeat-Sales Transactions-based Index vs NPI
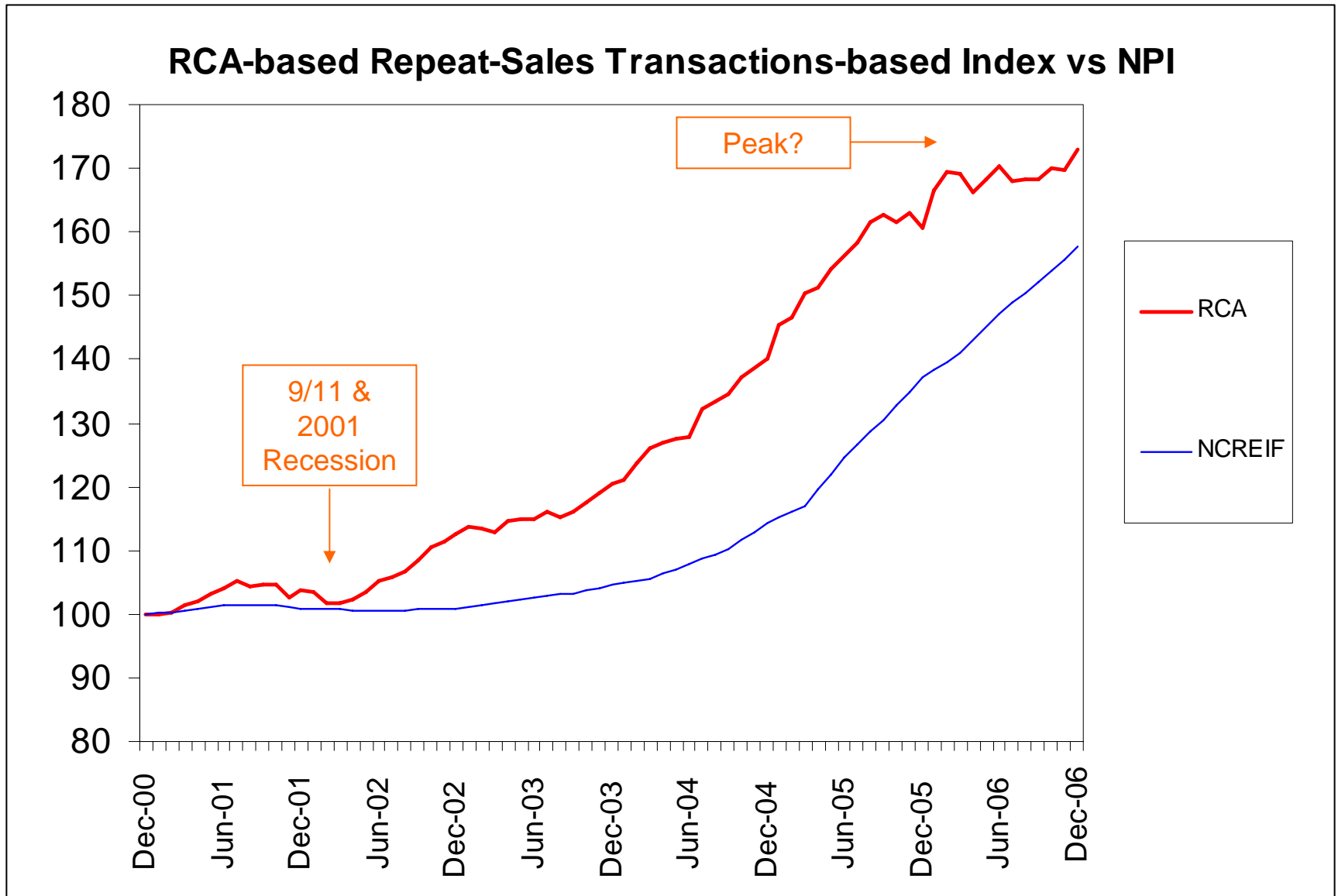
R.E. Index Swaps Trading Game

Put yourself in the shoes of one of two potential trading parties, in an imaginary scenario…

NewBalance Pension Fund currently has total assets of $300 million: $150M in stocks, $150M in bonds…

• CIO wants more diversification (less volatility), & is worried about near-term future outlook for stock & bond returns.

• Objective: Diversify quickly into real estate to obtain a balanced mixed-asset exposure across all 3 asset classes.

HedgeHog Asset Mgt.: Fund with specialized real estate expertise, a $100M all-real-estate fund that consistently earns positive alpha (beats RE index): Advertises alpha & protection of principal...

• CIO worried about near-term direction of RE mkts.

• Objective: Hedge RE mkt exposure, harvest alpha.

R.E. Index Swaps Trading Game

Swap contracts between the R.E.Index and LIBOR are available in denominations of $50M or $100M, guaranteed by a reliable clearinghouse (no counterparty risk).

Swap is based on R.E.Index Total Return.

Contract maturity is 3 years.

Notional trade (no cash up front).

Cash settlement at end of each year based on preceding year R.E.Index Total Return and LIBOR.

Price (spread to LIBOR, paid by Long to Short) to be agreed upon by parties.

No intermediary fees or transactions costs (no bid-ask spread).

R.E. Index Swaps Trading Game

Your job:

1. Decide whether you want to enter the Swap market, and on which side (long or short), and for how much ($50 or $100M contract).

2. Think about what price (spread to LIBOR) you think is fair, and/or what price you would agree to (for how much notional). (10 min for 1 & 2)

3. Negotiate a swap price and amount with one or more counterparties. (10 min)

4. Identify (and we'll assume you'll carry out) any other related covering or structuring investment transactions. (Just make a note: no time reqd)

R.E. Index Swaps Trading Game

Our job: We'll *create the future ! . . .*

We'll roll the clock forward one year at a time, and we'll see how each of you has done (calculate net cash flow)

After each year, and in total (after all 3 years, net):

Metrics: *Compare:*

Under Status Quo (no swap trade):	As Negotiated (with swap trade):
➔ Periodic returns	➔ Periodic returns
➔ Overall avg return*	➔ Overall avg return*
➔ Volatility	➔ Volatility

*Assume all cash reinvested per status quo: ➔

                            Time-wtd GMean ≈ IRR.

R.E. Index Swaps Trading Game

Possibly relevant (or not?) background info:

Current time is end of Year 0.

Recent past history of Stock, Bond, & R.E. markets (as tracked by relevant indexes) Total Returns:

Year:	Stocks:	Bonds:	R.E.:	LIBOR:
-2	15%	5%	10%	3%
-1	-15%	0%	20%	3%
0	10%	-3%	10%	3%

Current LIBOR rates for 1, 2, & 3-yr maturity = 3%.

Stock, Bond, & RE mkts (indexes) reflect equilibrium prices in those markets.

No transactions costs for any trades in the stock, bond, or LIBOR markets.

Hedge Hog will continue to earn 2%/yr positive alpha.

R.E. Index Swaps Trading Game

NewBalance Results: Fill in the blanks using *Excel* . . .

Asset Markets Outcomes & NewBalance Results:

Future *Ex Post* Returns:						NewBalance Returns:				
End of Yr:	Stk Retn	Bnd Retn	RE Retn	LIBOR	HHAM alpha	Yr:	w Swap	wout Swap		Differ:
1						1	0.00%	0.00%		0.00%
2						2	0.00%	0.00%		0.00%
3						3	0.00%	0.00%		0.00%
GMean:	0.00%	0.00%	0.00%			GMean:	0.00%	0.00%		0.00%
Volatility:	#DIV/0!	#DIV/0!	#DIV/0!			Volatility:	0.00%	0.00%		0.00%

Notional Amt of Swap: **WITH SWAP**
Price (Spread to LIBOR):

	NewBalance Assets:				Change in Value:					Returns:
End of Yr:	TotAssets	Stocks	Bonds	LIBORcover	TotAssets	Stocks	Bonds	LIBORcover	Swap	
0	$300.00	$150.00	$150.00	$0.00						
1	$300.00	$150.00	$150.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00%
2	$300.00	$150.00	$150.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00%
3	$300.00	$150.00	$150.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00%
GMean Return:	0.00%								AMean:	0.00%
Volatility:	0.00%									

Notional Amt of Swap: $0   **WITHOUT SWAP**
Price (Spread to LIBOR):   0.00%

	NewBalance Assets:				Change in Value:					Returns:
End of Yr:	TotAssets	Stocks	Bonds	LIBORcover	TotAssets	Stocks	Bonds	LIBORcover	Swap	
0	$300.00	$150.00	$150.00	$0.00						
1	$300.00	$150.00	$150.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00%
2	$300.00	$150.00	$150.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00%
3	$300.00	$150.00	$150.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00%
GMean Return:	0.00%								AMean:	0.00%
Volatility:	0.00%									

R.E. Index Swaps Trading Game

Hedge Hog Results: Fill in the blanks using *Excel* . . .

Asset Markets Outcomes & Hedge Hog Results:

Future *Ex Post* Returns:						Hedge Hog Returns:			
End of Yr:	Stk Retn	Bnd Retn	RE Retn	LIBOR	HHAM alpha	Yr:	w Swap	wout Swap	Differ:
1						1	0.00%	0.00%	0.00%
2						2	0.00%	0.00%	0.00%
3						3	0.00%	0.00%	0.00%
GMean:	0.00%	0.00%	0.00%			GMean:	0.00%	0.00%	0.00%
Volatility:	#DIV/0!	#DIV/0!	#DIV/0!			Volatility:	0.00%	0.00%	0.00%

Notional Amt of Swap: **WITH SWAP**
Price (Spread to LIBOR):

	Hedge Hog Assets:				Change in Value:			Returns:
End of Yr:	TotAssets	Stocks	Bonds	RE Assets	TotAssets	RE Assets	Swap CF	
0	$100.00	$0.00	$0.00	$100.00				
1	$100.00	$0.00	$0.00	$100.00	$0.00	$0.00	$0.00	0.00%
2	$100.00	$0.00	$0.00	$100.00	$0.00	$0.00	$0.00	0.00%
3	$100.00	$0.00	$0.00	$100.00	$0.00	$0.00	$0.00	0.00%
GMean Return:	0.00%						AMean:	0.00%
Volatility:	0.00%							

Notional Amt of Swap: $0   **WITHOUT SWAP**
Price (Spread to LIBOR): 0.00%

	Hedge Hog Assets:				Change in Value:			Returns:
End of Yr:	TotAssets	Stocks	Bonds	RE Assets	TotAssets	RE Assets	Swap CF	
0	$100.00	$0.00	$0.00	$100.00				
1	$100.00	$0.00	$0.00	$100.00	$0.00	$0.00	$0.00	0.00%
2	$100.00	$0.00	$0.00	$100.00	$0.00	$0.00	$0.00	0.00%
3	$100.00	$0.00	$0.00	$100.00	$0.00	$0.00	$0.00	0.00%
GMean Return:	0.00%						AMean:	0.00%
Volatility:	0.00%							

R.E. Index Swaps Trading Game

Example game outcome…

Suppose future returns turn out *ex post* as follows:

Year:	Stocks:	Bonds:	R.E.:	LIBOR:
1	8%	4%	-5%	3%
2	-17%	-11%	2%	3%
3	-2%	-1%	-4%	3%

And Hedge Hog makes 2% positive alpha each year.

Swap traded: NewBalance long, Hedge Hog short: $100M @ LIBOR (no spread) – which is the equilibrium price (assuming indexes were in equilibrium).

Then 3-yr results compared to status quo (no swap):
- NewBalance: Mean return up 47bps, Volatility down 452bps.
- Hedge Hog: Mean return up 515bps, Volatility down 342bps: earns pos retns even tho RE is down.

R.E. Index Swaps Trading Game

NewBalance Example Results (a given future "history", $100M notional trade at LIBOR flat):

Asset Markets Outcomes & NewBalance Results:

Future *Ex Post* Returns:						NewBalance Returns:			
End of Yr:	Stk Retn	Bnd Retn	RE Retn	LIBOR	HHAM alpha	Yr:	w Swap	wout Swap	Differ:
1	8.00%	4.00%	-5.00%	3.00%	2.00%	1	2.33%	6.00%	-3.67%
2	-17.00%	-11.00%	2.00%	3.00%	2.00%	2	-8.79%	-14.00%	5.21%
3	-2.00%	-1.00%	-4.00%	3.00%	2.00%	3	-2.39%	-1.50%	-0.89%
GMean:	-4.23%	-2.87%	-2.38%			GMean:	-3.06%	-3.53%	0.47%
Volatility:	12.58%	7.64%	3.79%			Volatility:	5.58%	10.10%	-4.52%

Notional Amt of Swap: $100   **WITH SWAP**
Price (Spread to LIBOR): 0.00%

	NewBalance Assets:				Change in Value:					Returns:
End of Yr:	TotAssets	Stocks	Bonds	LIBORcover	TotAssets	Stocks	Bonds	LIBORcover	Swap	
0	$300.00	$100.00	$100.00	$100.00						
1	$307.00	$103.50	$103.50	$100.00	$7.00	$8.00	$4.00	$3.00	-$8.00	2.33%
2	$280.02	$90.01	$90.01	$100.00	-$26.98	-$17.60	-$11.39	$3.00	-$1.00	-8.79%
3	$273.32	$86.66	$86.66	$100.00	-$6.70	-$1.80	-$0.90	$3.00	-$7.00	-2.39%
GMean Return:	-3.06%								AMean:	-2.95%
Volatility:	5.58%									

Notional Amt of Swap: $0   **WITHOUT SWAP**
Price (Spread to LIBOR): 0.00%

	NewBalance Assets:				Change in Value:					Returns:
End of Yr:	TotAssets	Stocks	Bonds	LIBORcover	TotAssets	Stocks	Bonds	LIBORcover	Swap	
0	$300.00	$150.00	$150.00	$0.00						
1	$318.00	$159.00	$159.00	$0.00	$18.00	$12.00	$6.00	$0.00	$0.00	6.00%
2	$273.48	$136.74	$136.74	$0.00	-$44.52	-$27.03	-$17.49	$0.00	$0.00	-14.00%
3	$269.38	$134.69	$134.69	$0.00	-$4.10	-$2.73	-$1.37	$0.00	$0.00	-1.50%
GMean Return:	-3.53%								AMean:	-3.17%
Volatility:	10.10%									

R.E. Index Swaps Trading Game

Hedge Hog Example Results (a given future "history", $100M notional trade at LIBOR flat):

Asset Markets Outcomes & Hedge Hog Results:

Future *Ex Post* Returns:						Hedge Hog Returns:			
End of Yr:	Stk Retn	Bnd Retn	RE Retn	LIBOR	HHAM alpha	Yr:	w Swap	wout Swap	Differ:
1	8.00%	4.00%	-5.00%	3.00%	2.00%	1	5.00%	-3.00%	8.00%
2	-17.00%	-11.00%	2.00%	3.00%	2.00%	2	4.95%	4.00%	0.95%
3	-2.00%	-1.00%	-4.00%	3.00%	2.00%	3	4.35%	-2.00%	6.35%
GMean:	-4.23%	-2.87%	-2.38%			GMean:	4.77%	-0.38%	5.15%
Volatility:	12.58%	7.64%	3.79%			Volatility:	0.36%	3.79%	-3.42%

Notional Amt of Swap:	$100	**WITH SWAP**						
Price (Spread to LIBOR):	0.00%							
	Hedge Hog Assets:				Change in Value:			Returns:
End of Yr:	TotAssets	Stocks	Bonds	RE Assets	TotAssets	RE Assets	Swap CF	
0	$100.00	$0.00	$0.00	$100.00				
1	$105.00	$0.00	$0.00	$105.00	$5.00	-$3.00	$8.00	5.00%
2	$110.20	$0.00	$0.00	$110.20	$5.20	$4.20	$1.00	4.95%
3	$115.00	$0.00	$0.00	$115.00	$4.80	-$2.20	$7.00	4.35%
GMean Return:	4.77%						AMean:	4.77%
Volatility:	0.36%							

Notional Amt of Swap:	$0	**WITHOUT SWAP**						
Price (Spread to LIBOR):	0.00%							
	Hedge Hog Assets:				Change in Value:			Returns:
End of Yr:	TotAssets	Stocks	Bonds	RE Assets	TotAssets	RE Assets	Swap CF	
0	$100.00	$0.00	$0.00	$100.00				
1	$97.00	$0.00	$0.00	$97.00	-$3.00	-$3.00	$0.00	-3.00%
2	$100.88	$0.00	$0.00	$100.88	$3.88	$3.88	$0.00	4.00%
3	$98.86	$0.00	$0.00	$98.86	-$2.02	-$2.02	$0.00	-2.00%
GMean Return:	-0.38%						AMean:	-0.33%
Volatility:	3.79%							

R.E. Index Swaps Trading Game

Previous example outcome is just illustrious, but:

• Swaps do enable investors to quickly diversify into real estate (effectively adding R.E. into the portfolio) at low transaction cost and with diversified R.E. holdings (index); and

• This does tend to reduce overall mixed-asset portfolio volatility (or higher returns at the same volatility using leverage), by reducing overexposure to stocks & bonds.

• Swaps do enable real estate investors to hedge against R.E. market downturns, protecting principal & enabling harvesting of positive "alpha" (generated by R.E. experts).