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Credit Derivatives 101

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Brain Teaser

Question: Let **X, Y ~ N(0,1)** be **i.i.d. random variables**.

What is the **probability** that **X > 3Y**?

Solution: Brain Teaser

Answer: The **probability** is **50%.**

Let us denote $Z = X - 3Y$ where we want to find $Z > 0$.

We can take the **expectation** of Z such that $\mathrm{E}[Z] = E[X] - 3E[Y] = 0$ by **linearity of expectations**.

Since $E[Z] = E[X] = E[Y]$ are **normally distributed around 0**, we must have $Z \sim N(0, \sigma) \rightarrow P(X > 3Y) = \frac{1}{2}$

Agenda

❖ Overview & Intuition

❖ The Two-Stage Auction

❖ CDS Basis

❖ ETFs & Correlation Trading

❖ Other Credit Derivatives

Overview & Intuition

Credit Default Swap (CDS)

❖ Form of credit derivative that **hedges** an **investor's exposure** to credit risk in a bond

Two Parties:
❖ Protection Seller: **Sells** the swap, takes a **bullish** view on credit risk
❖ Protection Buyer: **Buys** the swap, takes a **bearish** view on credit risk

Mechanics:
❖ **Buyer pays** the **basis** – annualized figure that is **usually paid quarterly**
❖ This **spread** is usually **100-bps** or **500-bps** (**difference** between fixed and market spread is **settled upfront**)

CDS Use Cases

Use Cases:

❖ **Reduce (or increase)**:
    ❖ Credit Exposure
    ❖ Credit Concentration (e.g., company, industry, country, etc.)

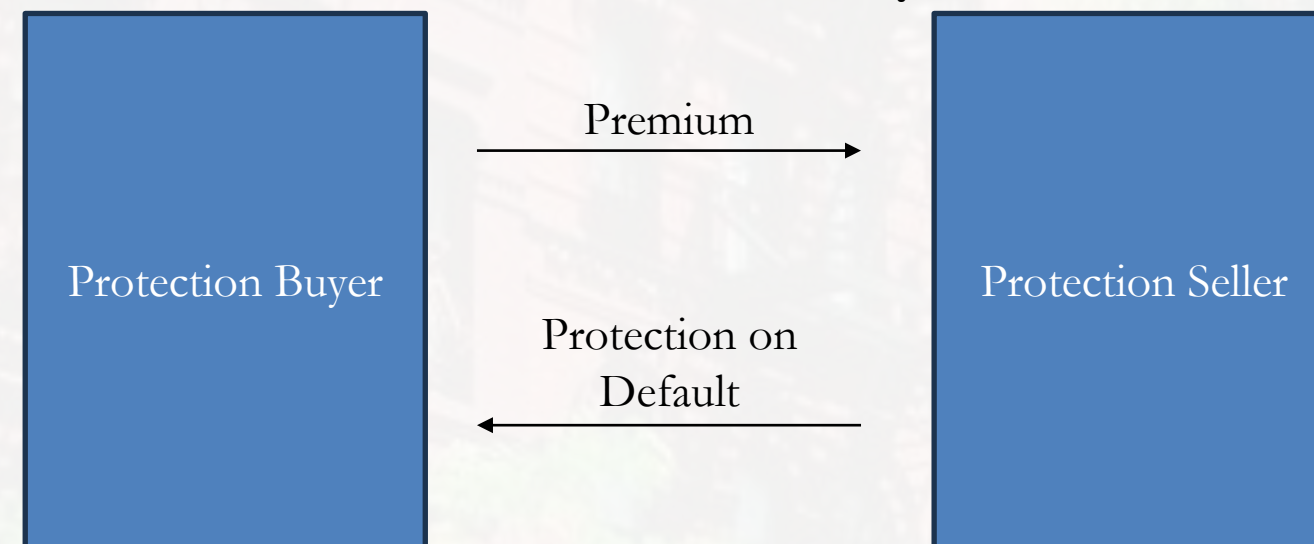❖ Take **short positions** in **defaultable bonds** (easier than in cash markets)

❖ **Change distribution** of credit quality
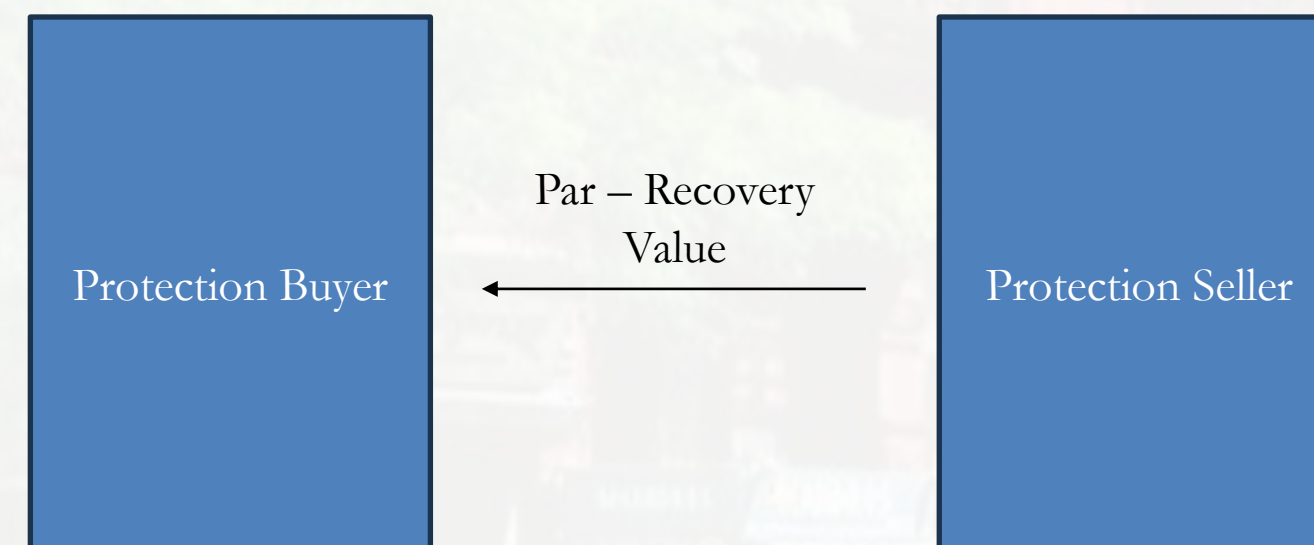
❖ Regulatory arbitrage:
    ❖ Seek > Regulated Leverage

CDS Transaction

CDS Cash Flows Before Maturity / Default

| Protection Buyer | → Premium → | Protection Seller |
| ← Protection on Default ← |

Cash Settlement in Case of Default

| Protection Buyer | ← Par – Recovery Value ← | Protection Seller |

Key Terms

Terms:

❖Reference Entity: company / country on which the contract is written

❖Reference Obligation: identifies **relevant seniority** of claims (i.e., point in the capital structure

❖Credit Events: Describes what **events** can **trigger default**

❖Obligation Category: Describes what types of **obligation** can trigger default

❖Deliverable Obligations: Describes what **obligations** can be **delivered** to the **seller** in settlement

CDS Triggers

Hard credit events:
- ❖ **Automatically triggers** CDS contracts.
- ❖ E.g., bankruptcy, failure to pay, obligation acceleration and default.

Soft credit events:
- ❖**No automatic trigger** of CDS.
- ❖E.g., "restructurings."

Restructuring credit events must be **binding** on **all holders**, leaving **voluntary restructurings** as a **gray area** under the law:
❖**Basel Laws** and a **lack of Chapter 11** rules in **Europe** leaves **restructurings relevant**.

Physical vs. Cash Settlement

Physically Settled:
❖Involves a **transfer of the physical**, **underlying good** (think: oil futures)

Cash Settled:
❖Involves a **transfer of cash** between both parties (think: Treasury futures)

Prior to the **mid-2000s**, CDS contracts were **physically settled derivatives**:
❖The CDS buyer would have to **enter the market** and **physically purchase the underlying bond** and transfer it to the CDS seller
❖The **rapid growth of CDS markets** as independent of the physical cash bond market **necessitated a shift towards cash settlement** to **avoid** market imbalances (e.g., a **short squeeze**).

CDS Auctions

Purpose:

❖ **Two-staged auction** designed to **mimic** a **physically settled contract**
❖ Traders submit physical settlement requests (PSRs)
  ❖ Long Protection: PSR to sell
  ❖ Short Protection: PSR to buy

Key Quantities:
1. Initial Market Midpoint (IMM)
2. Net Open Interest (NOI)
3. Adjustment Amounts

Stage I

Characteristics:

❖Traders submit prices to buy / sell defaulted security

❖**Determines** the **IMM** – places bounds on the final price

Adjustment Amounts:

❖**Penalties levied** for being on the **"wrong" side** of the market

❖Adjustment Amount = (Quoted Price – IMM) x 0.01 x Quotation Amount

Example: CIT Auction

Dealer	Bid	Offer
Bank of America Securities LLC	69.25	71.25
Barclays Bank PLC	67	69
BNP Paribas	69	71
Citigroup Global Markets Inc.	68.75	70.75
Credit Suisse International	70	72
Deustche Bank AG	70.25	72.25
Goldman Sachs & Co.	66.5	68.5
HSBC Bank USA, National Association	69	71
J.P. Morgan Securities, Inc.	69.75	71.75
Morgan Stanley & Co. Incorporated	68	70
Nomura International PLC	70	72
The Royal Bank of Scotland PLC	69	71
UBS Securities	70	72

Bid	Offer	Crossing
70.25	68.5	Y
70	69	Y
70	70	Y
70	70.75	N
69.75	71	N
69.25	71	N
69	71	N
69	71.25	N
69	71.75	N
68.75	72	N
68	72	N
67	72	N
66.5	72.25	N

Used to compute IMM

IMM: 70.25

Stage II

_____

Details:

❖Dealers **submit limit orders** to fill the Net-Open Interest

❖Auction Final Price: **price** of the **limit order** that **fills** the **NOI**:

    ❖ Final Price ≤ IMM + Cap Amount (if NOI is to sell)

    ❖ Final Price ≥ IMM – Cap Amount (if NOI is to buy)

Insufficient Limit Orders:

❖Final Price = 0 if **NOI** is to **"sell"**

❖Final Price = 100 if **NOI** is to **"buy"**

CDS Basis

CDS Trading

CDS Basis Trading:

$$CDS\ Basis = CDS\ Rate - Spread$$

❖If the **CDS basis spread** is **lower** than the **bond spread**, one can make a **negative basis trade:**
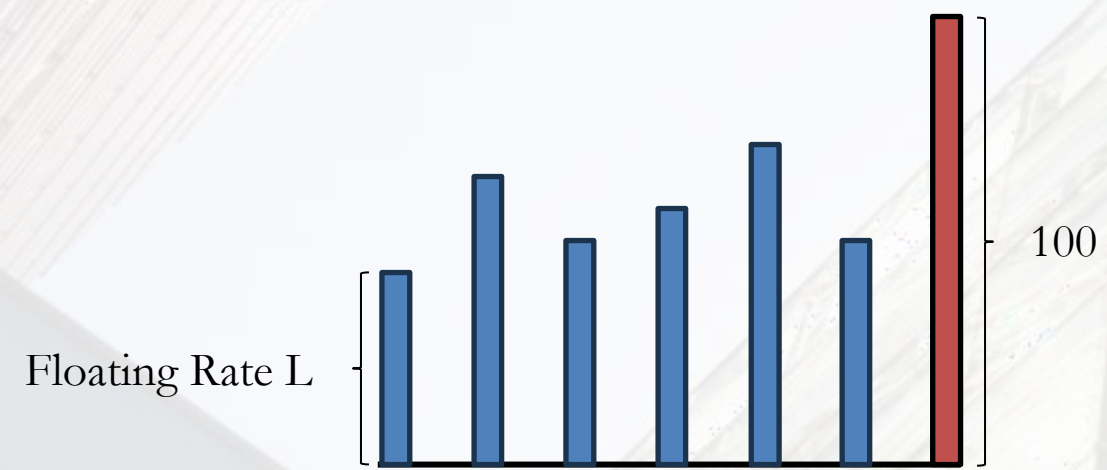   ❖ **Buy** the **bond** and **CDS – receive** the delta in **spread without risk.**

Other Trading Structures:
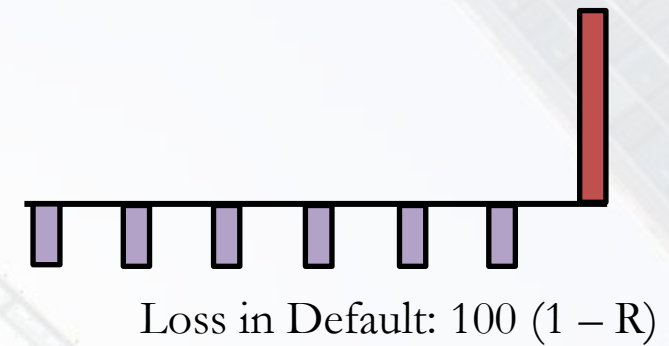❖Can be utilized as a **leveraged viewpoint** on **credit risk**
❖Traders employ CDS in **correlation trades** (via portfolios of CDS)
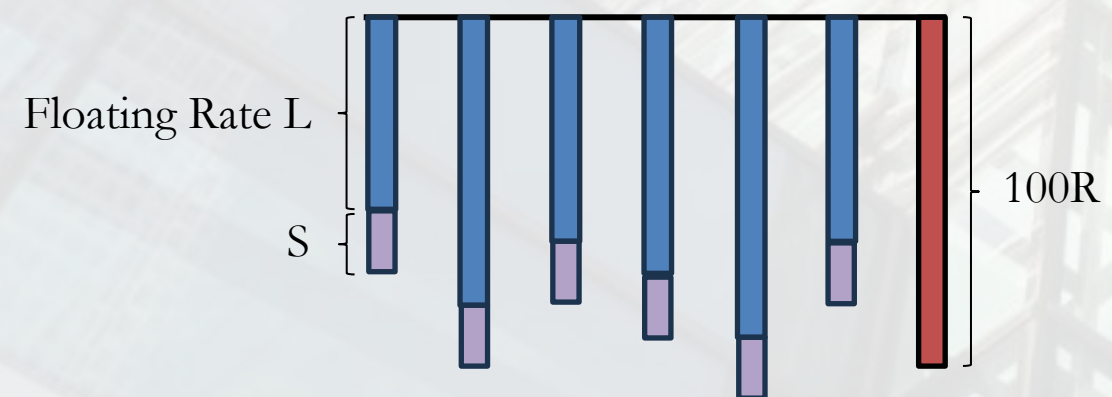
Synthetic CDS

Default-Free Floating Rate Note (Long)

Floating Rate L

100

Credit Default Swap

Loss in Default: 100 (1 – R)

Defaultable Floating Rate Note (Short)

Floating Rate L

S

100R

Takeaway:
A **long CDS position** can be **replicated** by **buying** a Default-Free Floating Rate Note and **shorting** a Defaultable Floating Rate Note

Dealer Perspective

Transaction	Cash Flow		Default Event Payment	Cash Flow at Maturity
	Now	Period		
Write Default Protection	0	d	-100(1-R)	0
Borrow Bond & Sell	+100	-(L+S)	-100R	-100
Invest Proceeds	-100	r	+100	+100
Total	0	d - [S + (L - r)]	0	0

$R: Recovery\ Rate;\ L: SOFR;\ S: Floating\ Rate\ Spread; r = Repo\ Rate; d: CDS\ Rate$

$$CDS\ Rate\ (Ask) = Spread + (SOFR - Repo) \rightarrow d = S + (L - r)$$

Investor Perspective

Transaction	Cash Flow		Default Event Payment	Cash Flow at Maturity
	Now	Period		
Buy Default Protection	0	-d	+100(1-R)	0
Buy Bond	-100	+(L+S)	+100R	+100
Finance Bonds	+100	$-r_B$	-100	-100
Total	0	$-d + [S + (L - r_B)]$	0	0

$R: Recovery\ Rate;\ L: SOFR;\ S: Floating\ Rate\ Spread;\ r_B: Financing\ Rate;\ d: CDS\ Rate$

$$CDS\ Rate\ (Bid) = Spread - (Financing - SOFR) \rightarrow d = S - (r_B - L)$$

The Full Picture

$$CDS = + \begin{cases} L - repo \\ L - r_B \end{cases} \rightarrow basis = CDS - S = \begin{cases} L - repo : ask \\ L - r_B : bid \end{cases}$$

Positive Basis	Negative Basis
❖ **High demand** for credit protection	❖ **Large supply** of credit protection
❖ **Difficult** / expensive to **short bonds** (repo rate low)	❖ Financing above SOFR
❖ Funding below par	❖ **Counterparty risk**
❖ Cheapest-to-deliver option	

ETFs & Correlation Trading

CDS ETFs

CDS Index: Portfolio of single-name CDS
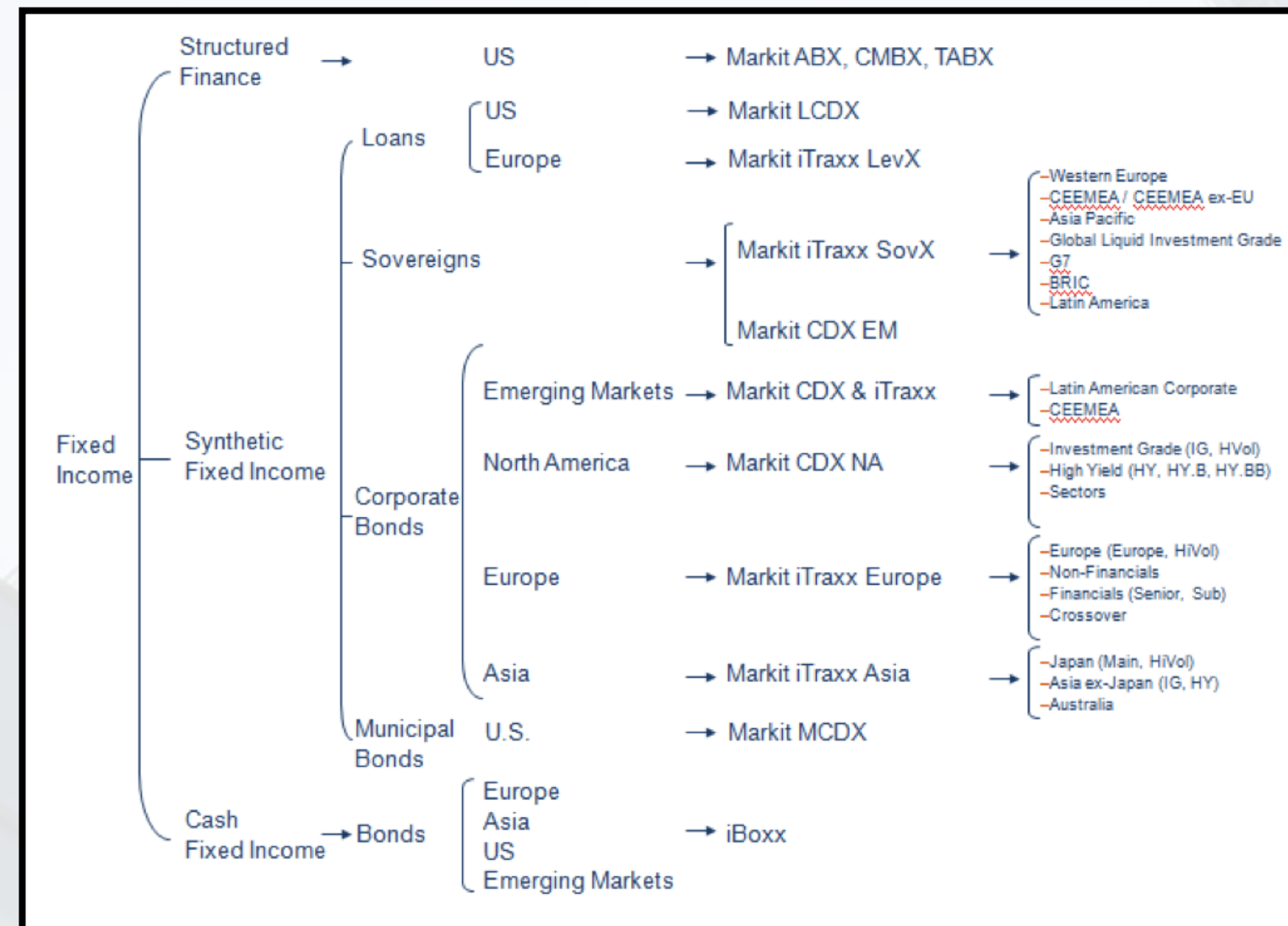❖**Protection seller** provides protection (and receives premium) on a **portfolio of names**

Important: Major indices are **centrally cleared**

Dynamics:
❖**Equal notional weightings** for all credits
❖**Reference entities cannot be added** and will **only be removed** upon the triggering of a credit event
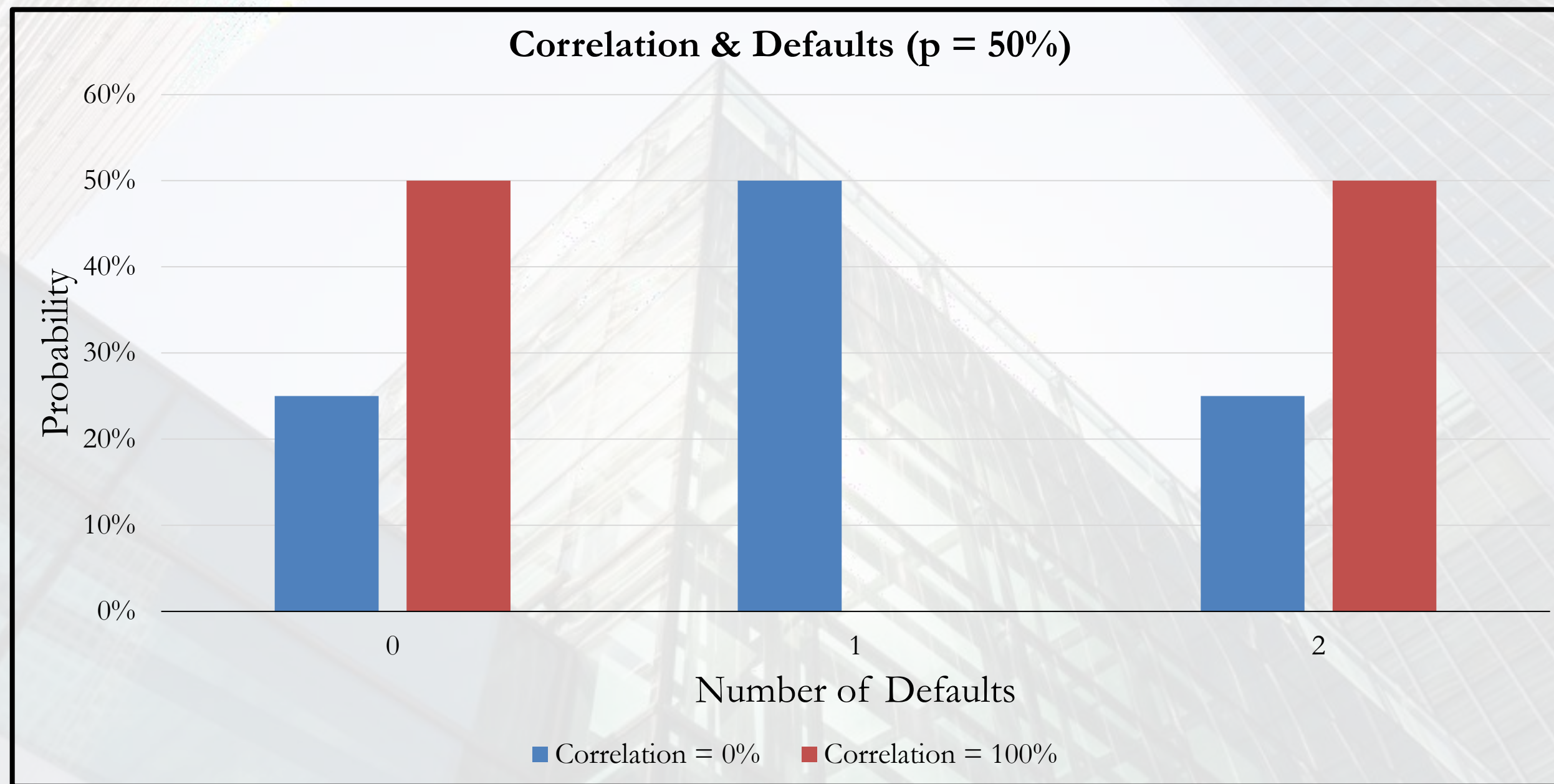
CDS ETFs (cont.)

Importance of CDS ETFs

CDS ETFs provide investors with the ability to:
- ❖Take **long** and **short** positions in credit
- ❖Take **credit exposure** on either a **leveraged** or **unleveraged** basis

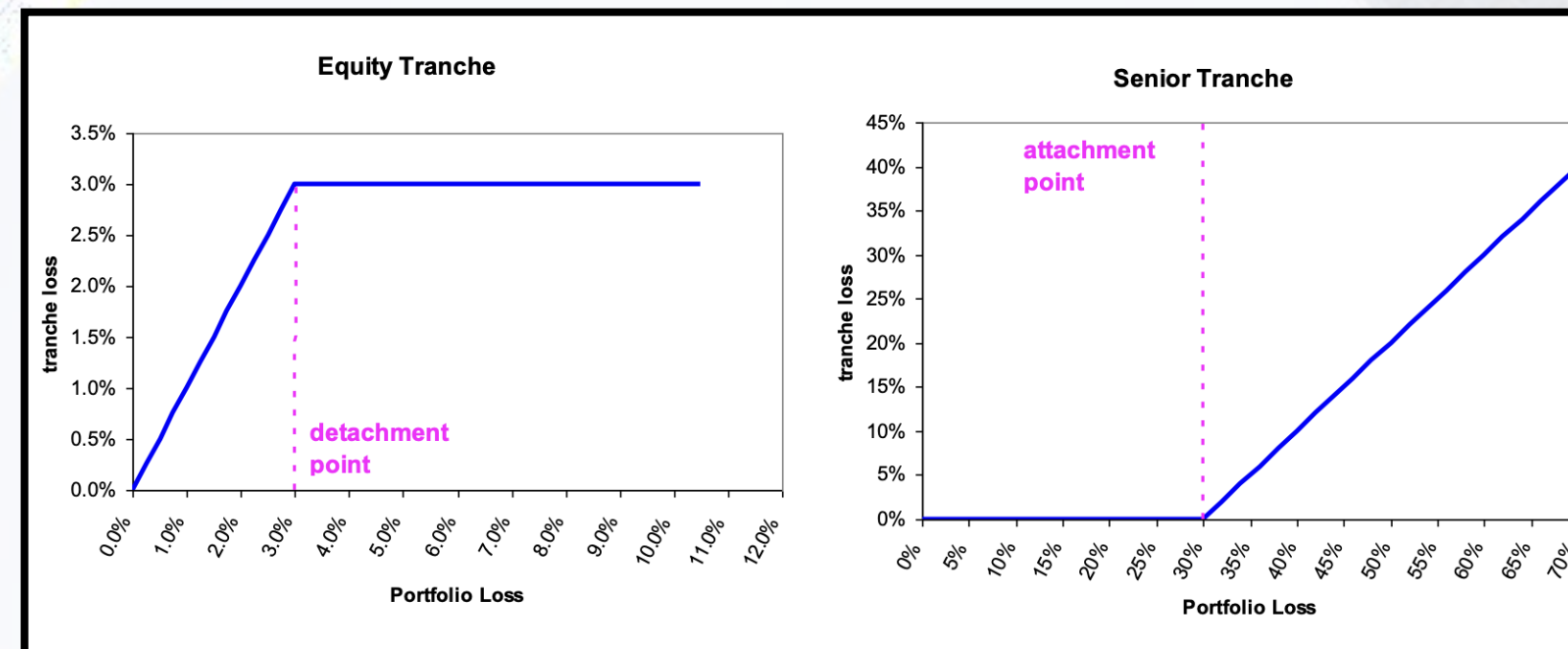Index products provide:
- ❖**Ability** to **customize exposure** (e.g., geographically, industry-based, credit quality)
- ❖Ability to **hedge single name credit** against **movements** in the **market spread**
- ❖High liquidity

CDS ETFs & Correlation

Correlation & Defaults (p = 50%)

Legend: Correlation = 0% (blue), Correlation = 100% (red)

X-axis: Number of Defaults (0, 1, 2)
Y-axis: Probability (0% to 60%)
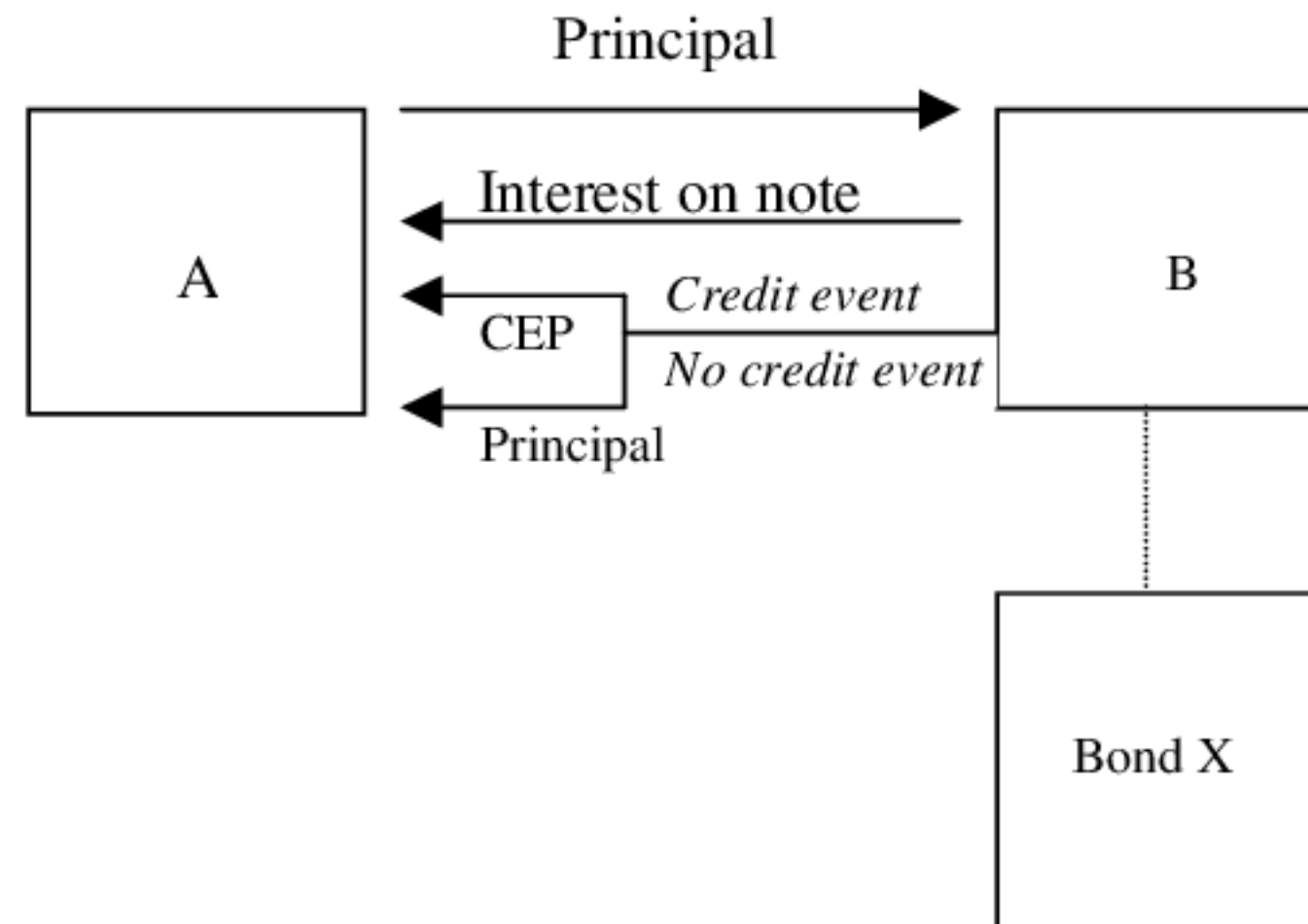
CDS ETFs & Correlation (cont.)

Overview:

❖ With a **fixed recovery rate**, the **distribution of portfolio losses** is the **distribution** of the **number of defaults**

❖ **Equity tranche loss** is **concave** in **portfolio loss** – expected loss on tranches **decreases** with **variance of portfolio loss**; **senior tranche** is **convex** in **portfolio loss**

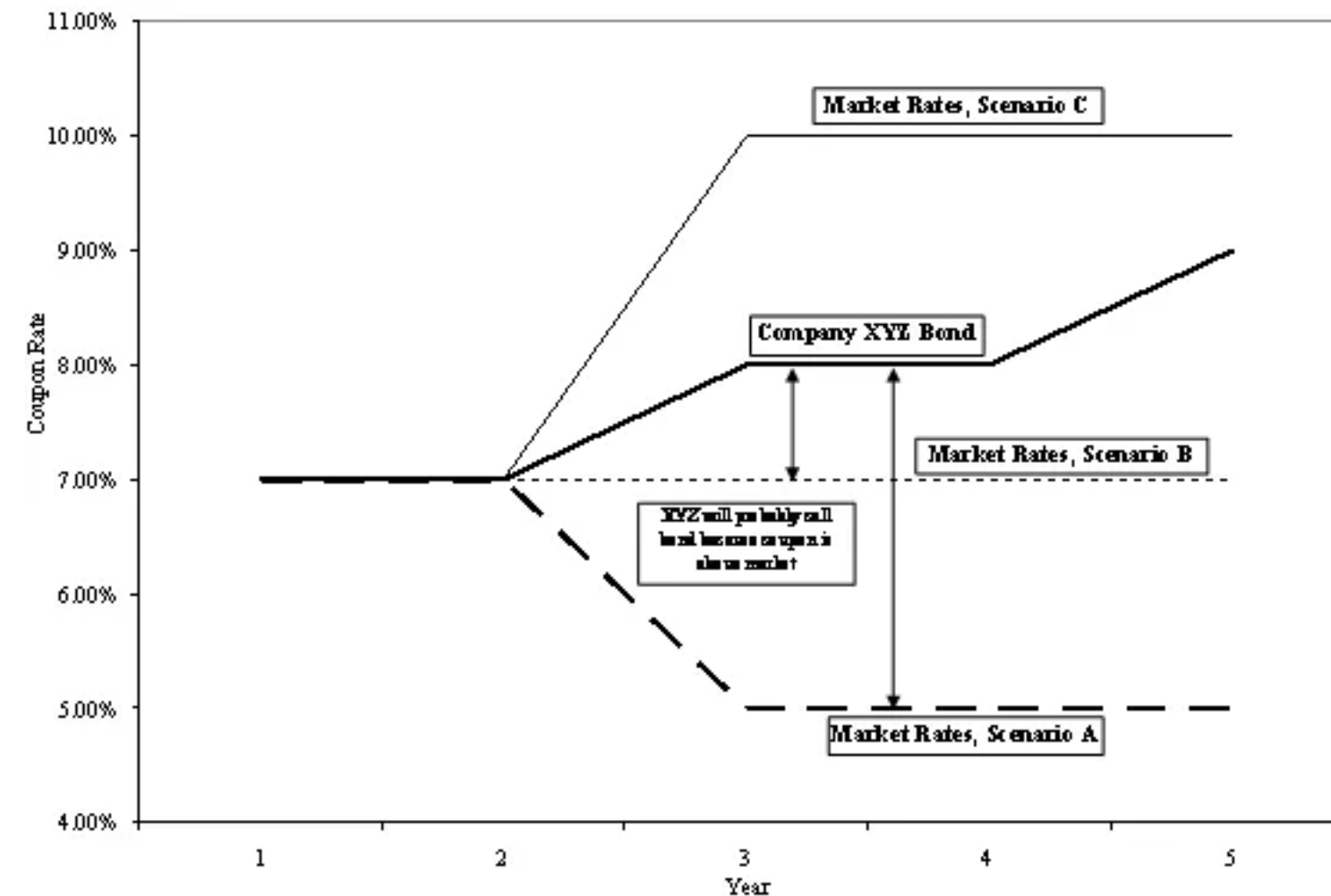# Other Credit Derivatives

Credit-Linked Notes

Overview:

❖ A **bond** where the **payment** to the **buyer** is **reduced** in the **event** of **default** of the reference entity

❖ **Buyer** is **selling credit protection** where he/she **puts up compensation** for **default** in advance

Step-Up Bond

Overview:
- ❖ The **coupon paid** is **increased** if the **credit rating** of the **issuer falls** to specified threshold
- ❖ The European Telecoms industry has around 65 issues with over Euro 100 billion outstanding
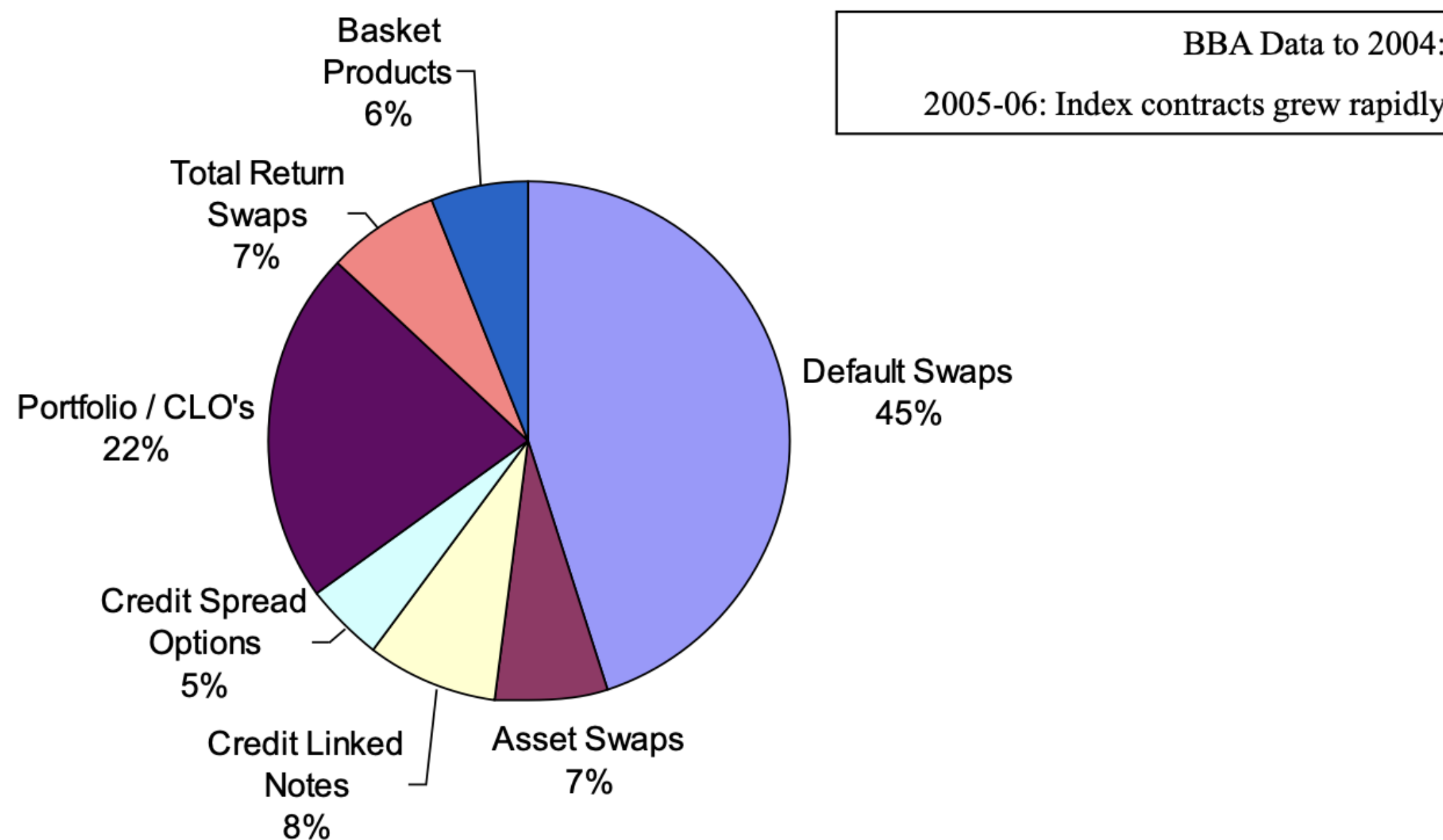- ❖ Deutsche Bank and France Telecom are the largest issuers

Total-Rate-of-Return Swaps
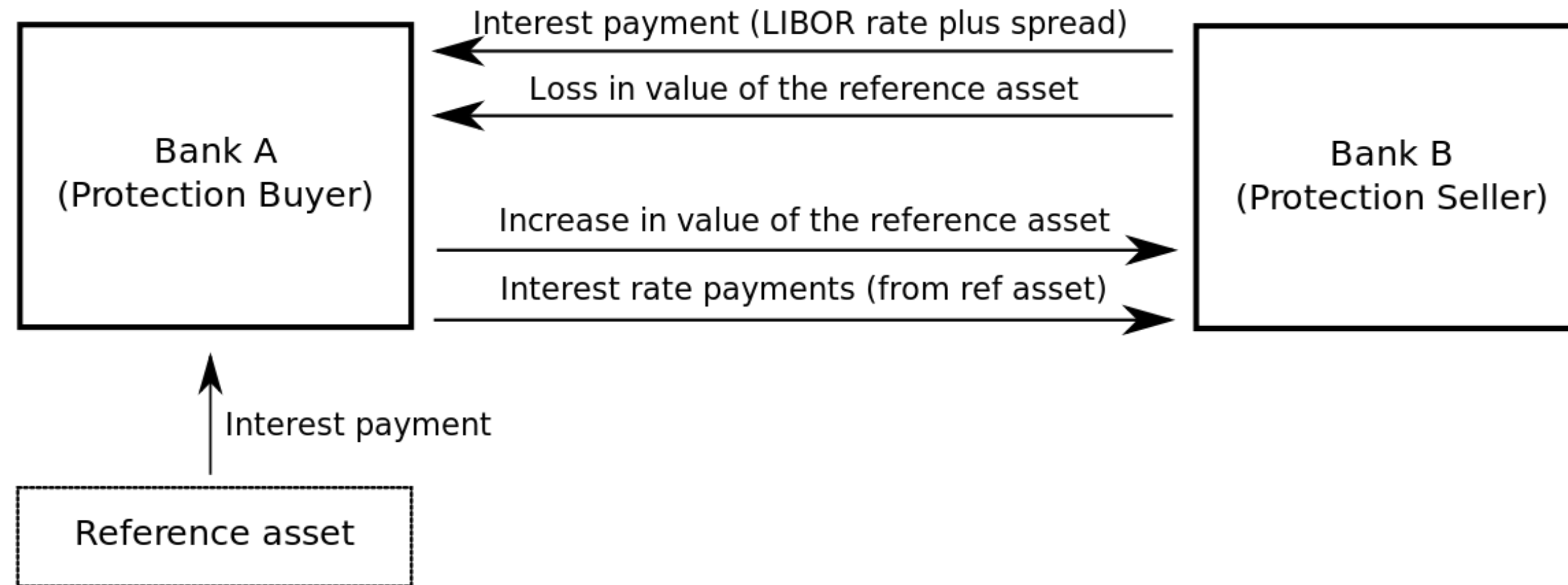
Overview:
❖ **Pays** the **difference** between between **total mark-to-market rate of return** on **credit risky bond** and (e.g.) government bond
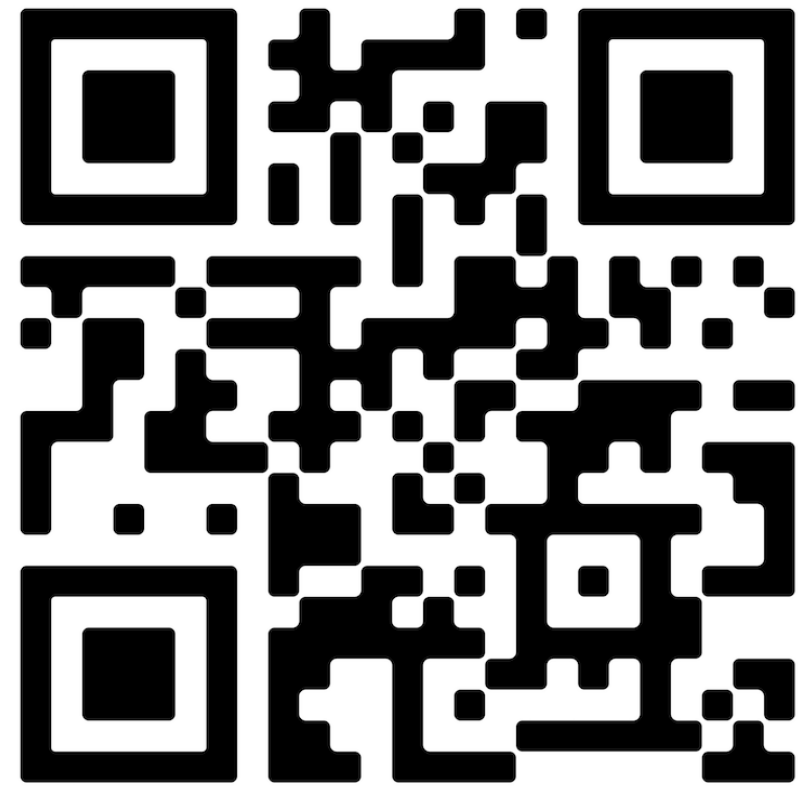
Credit Derivatives Product Mix

Basket Products 6%

Total Return Swaps 7%

Portfolio / CLO's 22%

Credit Spread Options 5%

Credit Linked Notes 8%

Asset Swaps 7%

Default Swaps 45%

BBA Data to 2004:

2005-06: Index contracts grew rapidly

Source: British Bankers Association (BBA)

Links

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