1.2 Product nature of credit derivatives

Payoff depends on the occurrence of a credit event:

- default: any non-compliance with the exact specification of a contract
- price or yield change of a bond
- credit rating downgrade

In the case of the default of a bond, any loss in value from the default date until the pricing date (a specified time period after the default date) becomes the value of the underlying.

Credit derivatives can take the form of swaps or options.

1. In a credit swap, one party pays a fixed cashflow stream and the other party pays only if a credit event occurs (or payment based on yield spread).
2. A credit option would require the upfront premium and would pay off based on the occurrence of a credit event (or on a yield spread).

Pricing a credit derivative is not straightforward since modeling the stochastic process driving the underlying's credit risk is challenging.

Reference asset

- actively-traded corporate or sovereign bond or a portfolio of these bonds;
- portfolio of loans

Reference rate

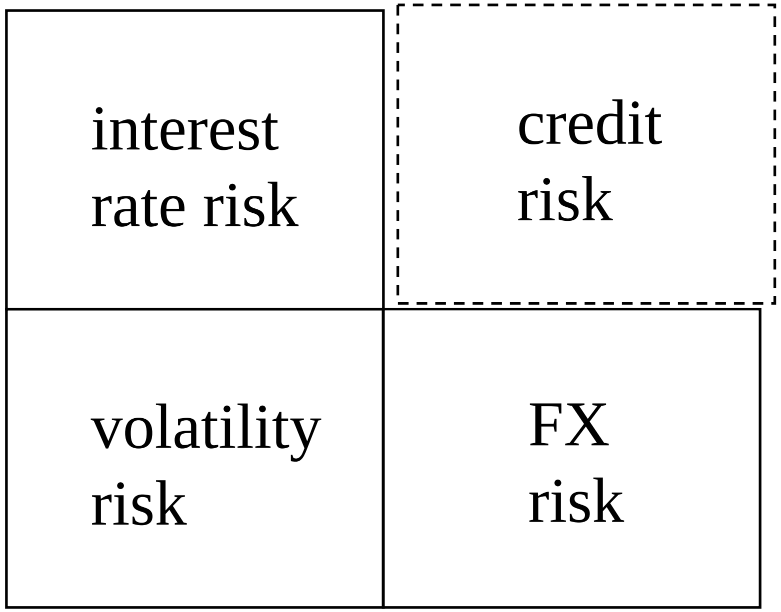
An agreed fixed or floating interest rate e.g. 3-month LIBOR

Default payment

- post default price of the reference asset or determined by a dealer pool;
- fixed percentage of the notional amount of the transaction payment of par by the seller in exchange for physical delivery of the defaulted reference asset.

Risk de-aggregation

Credit derivatives are over-the-counter contracts which allow the isolation and management of credit risk from all other components of risk.



Off-balance sheet financial instruments that allow end users to buy and sell credit risk.

Uses of credit derivatives

To *hedge* against an increase in risk, or to gain *exposure* to a market with higher risk.

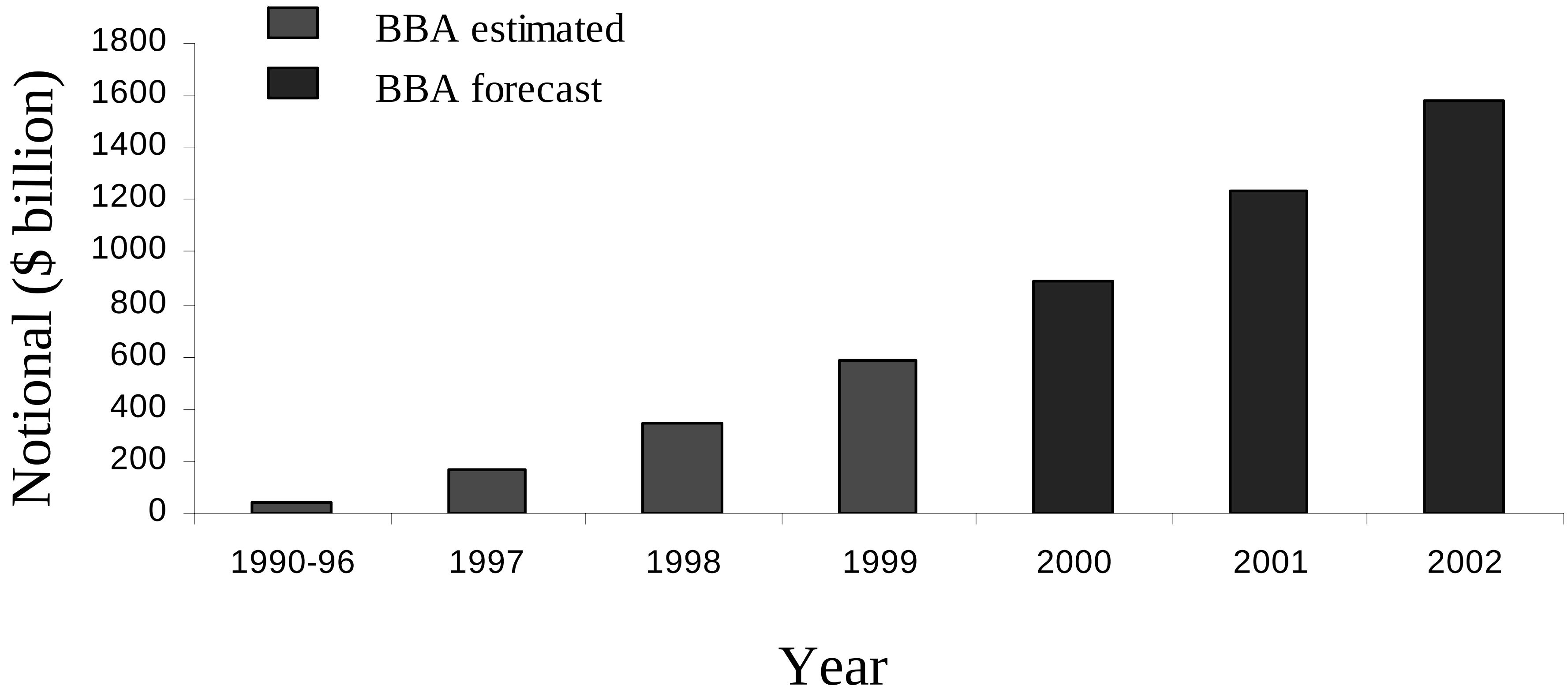
- Creating customized exposure; e.g. gain exposure to Russian debts (rated below the manager's criteria per her investment mandate).

- Leveraging credit views - restructuring the risk/return profiles of credits.

- Allow investors to eliminate credit risk from other risks in the investment instruments.

Credit derivatives allow investors to take advantage of relative value opportunities by exploiting inefficiencies in the credit markets.

Size of the credit derivative market



Source: British Bankers Association

Definition of a credit derivative

1. *Based on intended use*

   A derivative security that is primarily used to transfer, hedge or manage credit risk.

2. *Based on nature of payoff*

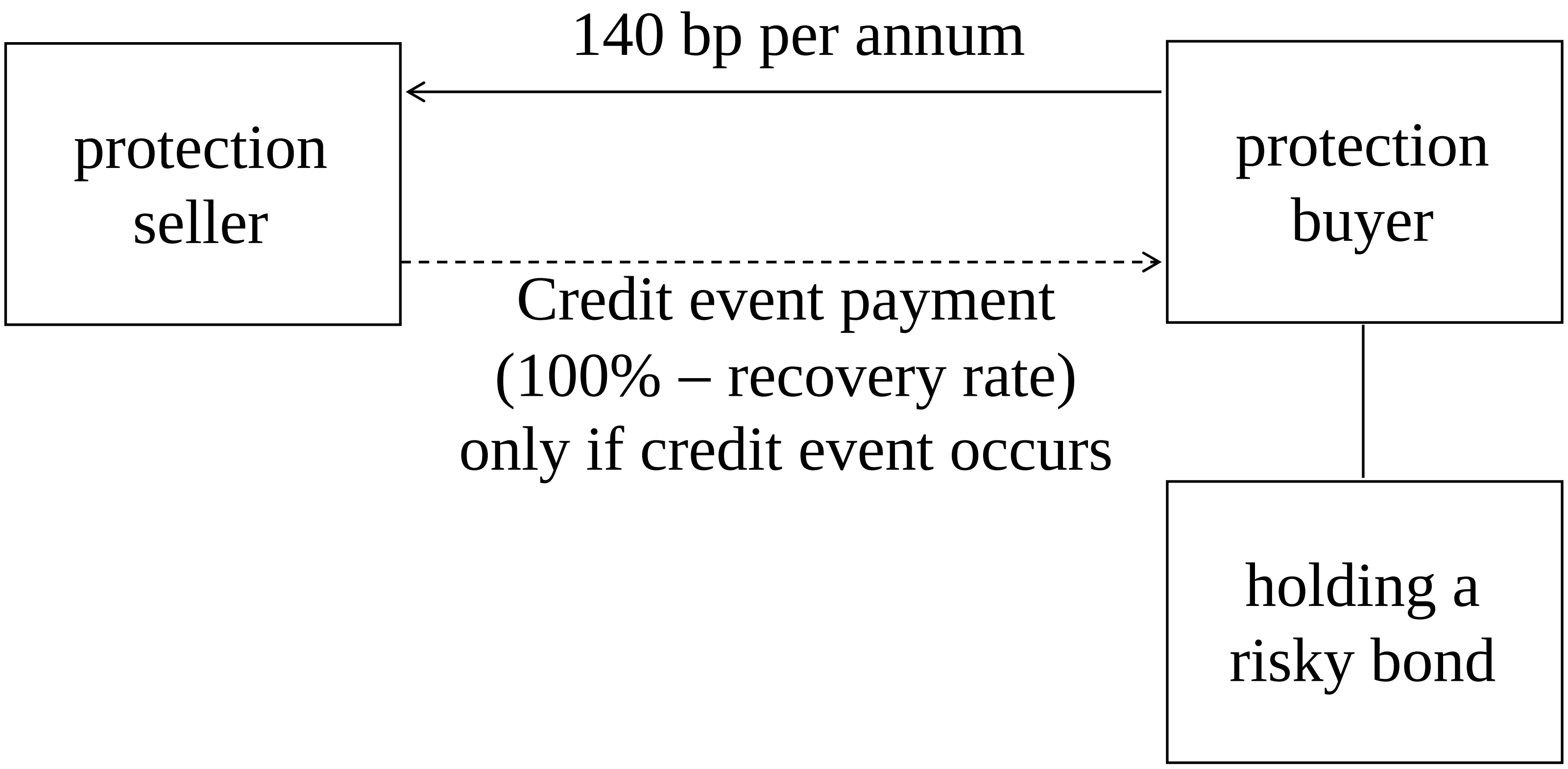
   A derivative security whose payoff is materially effected by credit risk.

Common types of credit derivatives

1. Credit default swaps
2. Asset swaps and total return swaps
3. Credit spread options
4. Credit linked notes
5. Default correlation products:
   basket default swaps and collateralized debt obligations

Credit default swaps

The protection seller receives fixed periodic payments from the protection buyer in return for making a single contingent payment covering losses on a reference asset following a default.



Protection seller

- earns investment income with no funding cost
- gains customized, synthetic access to the risky bond

Protection buyer

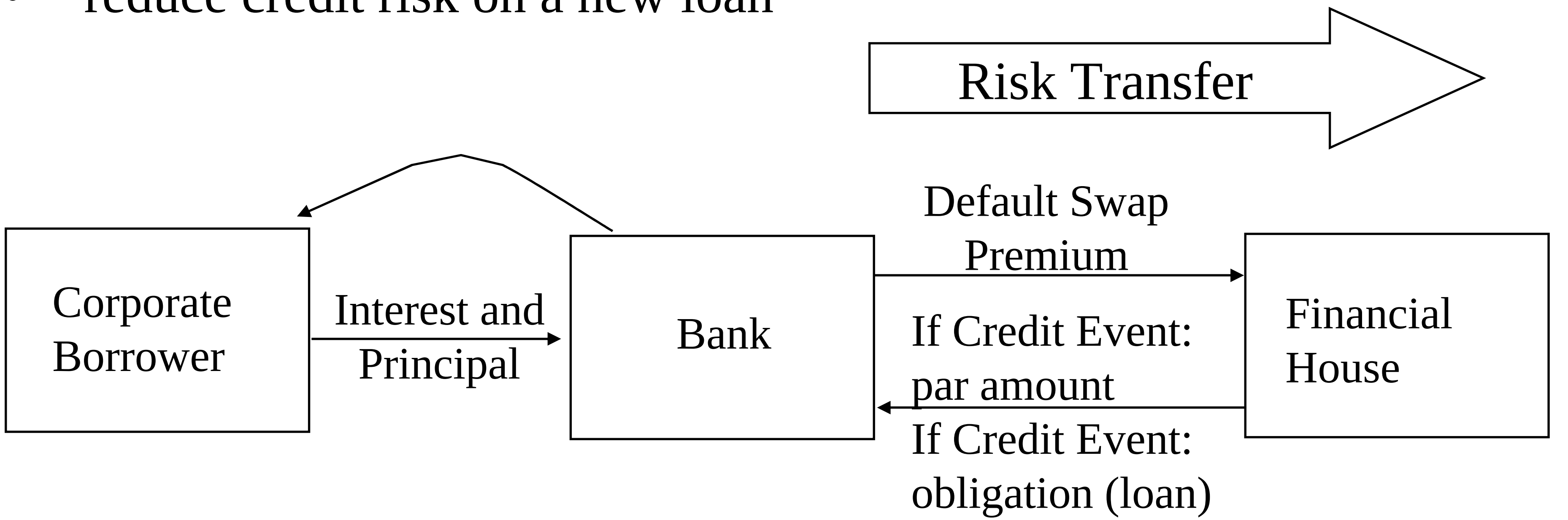
- hedges the default risk on the reference asset

1. Very often, the bond tenor is longer than the swap tenor. In this way, the protection seller does not have exposure to the full market risk of the bond.
2. *Basket default swap* – gain additional yield by selling default protection on several assets.

A bank lends 10mm to a corporate client at L + 65bps. The bank also buys 10mm default protection on the corporate loan for 50bps.

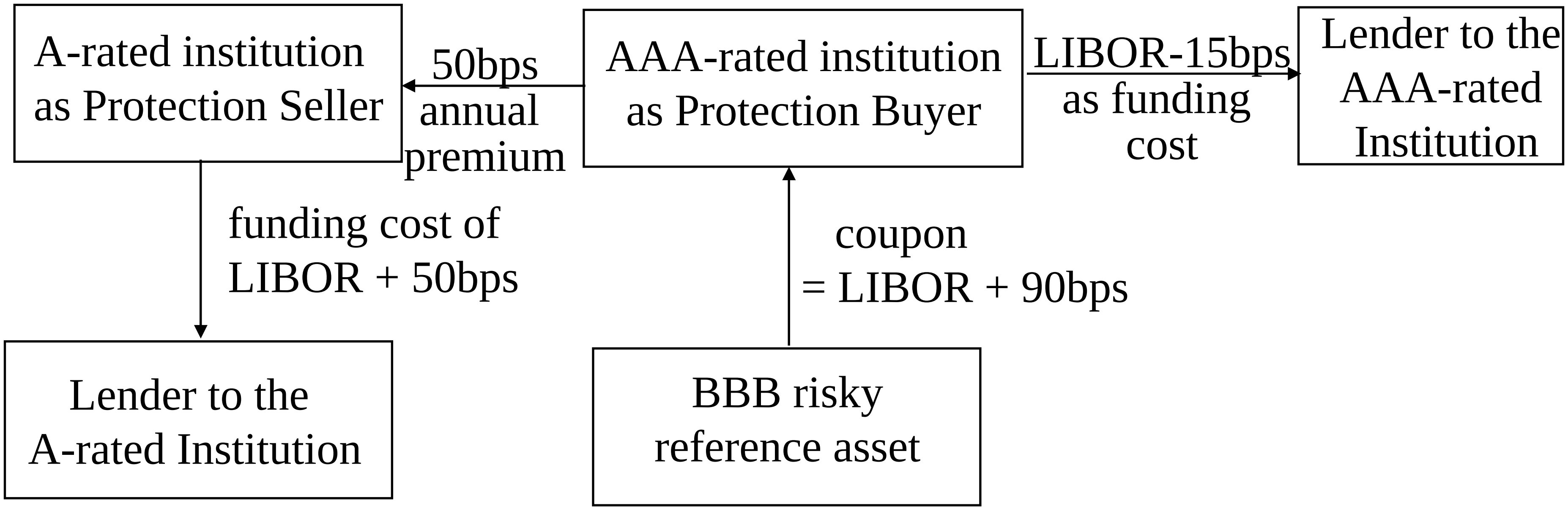
Objective achieved

- maintain relationship
- reduce credit risk on a new loan



Default Swap Settlement following Credit Event of Corporate Borrower

Funding cost arbitrage – Credit default swap



The combined risk faced by the Protection Buyer:

• default of the BBB-rated bond

• default of the Protection Seller on the contingent payment

The AAA-rated Protection Buyer creates a *synthetic AA-asset* with a coupon rate of LIBOR + 90bps – 50bps = LIBOR + 40bps.

This is better than LIBOR + 30bps, which is the coupon rate of a AA-asset (net gains of 10bps).

For the A-rated Protection Seller, it gains synthetic access to a BBB-rated asset with earning of net spread of

$$50\text{bps} - [\underbrace{(\text{LIBOR} + 90\text{bps}) - (\text{LIBOR} + 50\text{bps})}_{\begin{array}{l}\text{the A-rated Protection Seller earns}\\ \text{40bps if it owns the BB asset directly}\end{array}}] = 10\text{bps}$$

In order that the credit arbitrage works, the funding cost of the default protection seller must be *higher* than that of the default protection buyer.

Example

Suppose the A-rated institution is the Protection buyer, and assume that it has to pay 60bps for the credit default swap premium (higher premium since the AAA-rated institution has lower counterparty risk).

The net loss of spread = (60 – 40) = 20bps.

Supply and demand drive the price

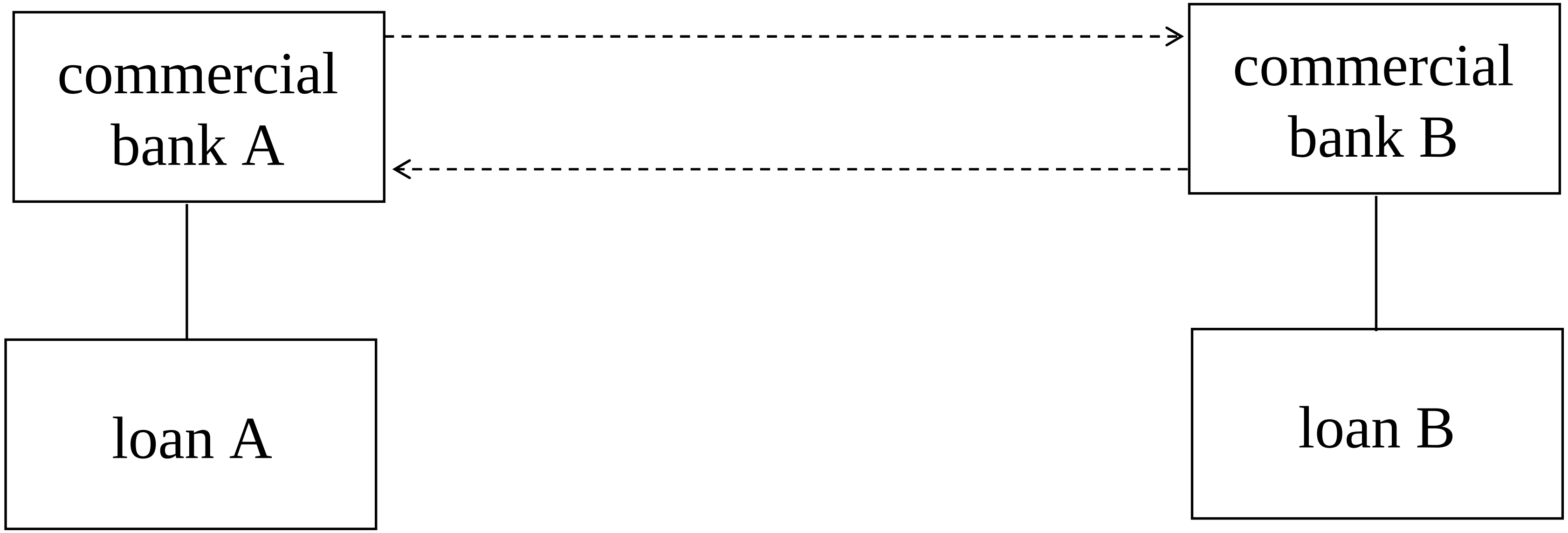
Credit Default Protection Referencing a 5-year
Brazilian Eurobond (May 1997)

Chase Manhattan Bank	240bps
Broker Market	285bps
JP Morgan	325bps

* It may be that Chase had better advantage to hedge the credit default protection sold, so they were willing to offer a good price.

Credit default exchange swaps

Two institutions that lend to different regions or industries can diversify their loan portfolios in a single non-funded transaction – hedging the concentration risk on the loan portfolios.



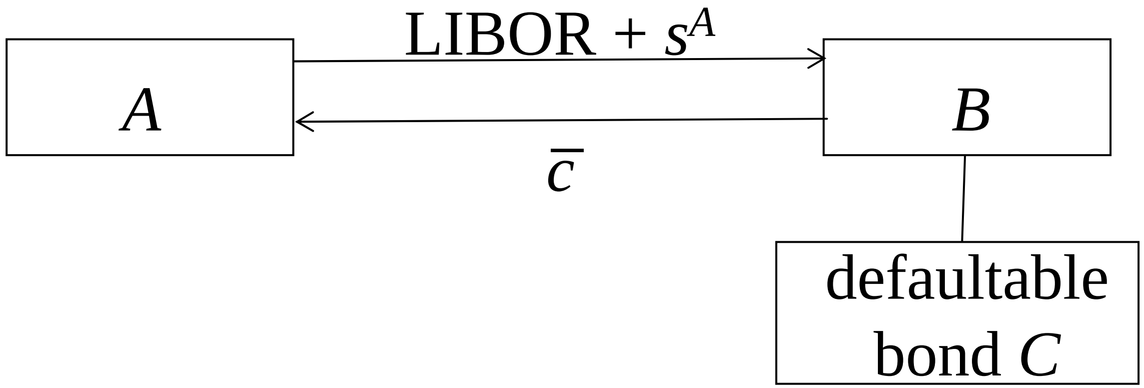
* contingent payments are made only if credit event occurs on a reference asset
* periodic payments may be made that reflect the different risks between the two reference loans

Asset swap

- Combination of a defaultable bond with an interest rate swap.

  B pays the notional amount upfront to acquire the asset swap package.

  1. A fixed coupon bond issued by C with coupon $\overline{c}$ payable on coupon dates.
  2. A fixed-for-floating swap.



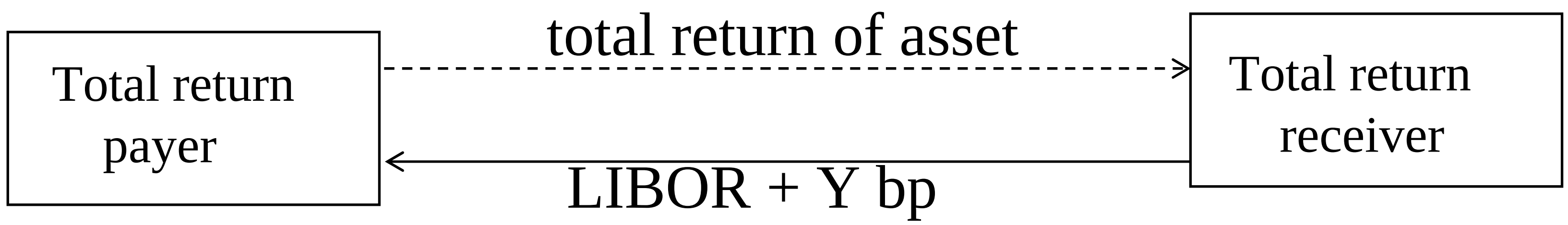
The asset swap spread s^A is adjusted to ensure that the asset swap package has an initial value equal to the notional.

Remarks

1. Asset swaps are more liquid than the underlying defaultable bond.
2. An asset swaption gives B the right to enter an asset swap package at some future date T at a predetermined asset swap spread s^A.

Total return swap

- Exchange the total economic performance of a specific asset for another cash flow.



Total return comprises the sum of interests, fees and any change-in-value payments with respect to the reference asset.

A commercial bank can hedge all credit risk on a loan it has originated. The counterparty can gain access to the loan on an off-balance sheet basis, without bearing the cost of originating, buying and administering the loan.

The payments received by the total return receiver are:

1. The coupon $\bar{c}$ of the bond (if there were one since the last payment date T_{i-1})
2. The price appreciation $\left(\bar{C}(T_i) - \bar{C}(T_{i-1})\right)^+$ of the underlying bond C since the last payment (if there were only).
3. The recovery value of the bond (if there were default).

The payments made by the total return receiver are:

1. A regular fee of LIBOR + s^{TRS}
2. The price depreciation $\left(\bar{C}(T_{i-1}) - \bar{C}(T_i)\right)^+$ of bond C since the last payment (if there were only).
3. The par value of the bond C if there were a default in the meantime).

The coupon payments are netted and swap's termination date is earlier than bond's maturity.

Some essential features

1. The receiver is synthetically long the reference asset without having to fund the investment up front. He has almost the same payoff stream as if he hand invested in risky bond directly and funded this investment at LIBOR + s^{TRS}.

2. The TRS is marked to market at regular intervals, similar to a futures contract on the risky bond. The reference asset should be liquidly traded to ensure objective market prices for making to market (determined using a dealer poll mechanism).

3. The TRS allows the receiver to leverage his position much higher than he would otherwise be able to (may require collateral). The TRS spread should not be driven by the default risk of the underlying asset but also by the credit quality of the receiver.

Used as a financing tool

- The receiver wants financing to invest \$100 million in the reference bond. It approaches the payer (a financial institution) and agrees to the swap.
- The payer invests \$100 million in the bond. The payer retains ownership of the bond for the life of the swap and has much less exposure to the risk of the receiver defaulting.
- The receiver is in the same position as it would have been if it had borrowed money at LIBOR + s^{TRS} to buy the bond. He bears the market risk and default risk of the underlying bond.

Motivation of the receiver

1. Investors can create *new assets* with a *specific maturity* not currently available in the market.
2. Investors gain *efficient off-balance sheet exposure* to a desired asset class to which they otherwise would not have access.
3. Investors may achieve a *higher leverage on capital* – ideal for hedge funds. Otherwise, *direct asset ownership* is on *on-balance sheet* funded investment.
4. Investors can *reduce administrative costs* via an off-balance sheet purchase.
5. Investors can *access entire asset classes* by receiving the total *return on an index*.

Motivation of the payer

The payer creates a hedge for both the *price risk* and *default risk* of the reference asset.

* A long-term investor, who feels that a reference asset in the portfolio may *widen in spread* in the *short term* but will recover later, may enter into a total return swap that is shorter than the maturity of the asset. This structure is *flexible* and *does not require a sale of the asset* (thus accommodates a temporary *short-term negative view* on an asset).

Credit spread derivatives

- Options, forwards and swaps that are linked to credit spread.

  Credit spread = yield of debt – risk-free or reference yield

- Investors gain protection from any degree of credit deterioration resulting from ratings downgrade, poor earnings etc.
  (This is unlike default swaps which provide protection against defaults and other clearly defined 'credit events'.)

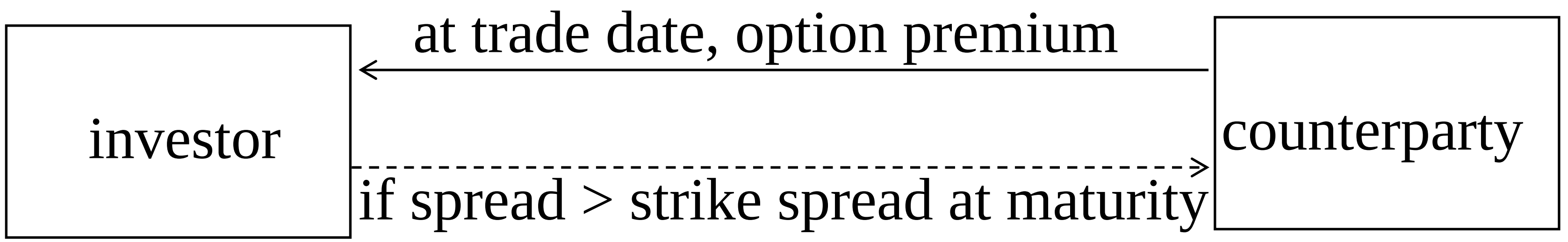
Credit spread option

Use credit spread option to

- hedge against rising credit spreads;
- target the future purchase of assets at favorable prices.

Example

An investor wishing to buy a bond at a price below market can sell a credit spread option to target the purchase of that bond if the credit spread increases (earn the premium if spread narrows).



$$\text{Payout} = \text{notional} \times (\text{final spread} - \text{strike spread})^+$$

Example

The holder of the put has the right to sell the bond at the strike spread (say, spread = 330 bps) when the spread moves above the strike spread (corresponding to drop of bond price).

May be used to target the future purchase of an asset at a favorable price.

The investor intends to purchase the bond below current market price (300 bps above US Treasury) in the next year and has targeted a forward purchase price corresponding to a spread of 350 bps. She sells for 20 bps a one-year credit spread put struck at 330 bps to a counterparty (currently holding the bond and would like to protect the market price against spread above 330 bps).

- *spread* < 330; investor earns the premium
- *spread* > 330; investor acquires the bond at 350 bps

Credit-linked notes

They are structured notes embedded with the *credit option*.

- To allow the issuer to reduce the coupon rate if the reference financial index deteriorates
- To reduce the credit exposure of the issuer
- To provide higher rate of return to holders; the extra return is used to compensate the credit risk transferred to the holders.

Example

One-year credit-linked note issued by a credit card company

- promises to pay $1,000 and an 8% coupon if the index of credit delinquency rate is below 5%;
- if index > 5%, then coupon rate falls to 4%.

Basket default notes

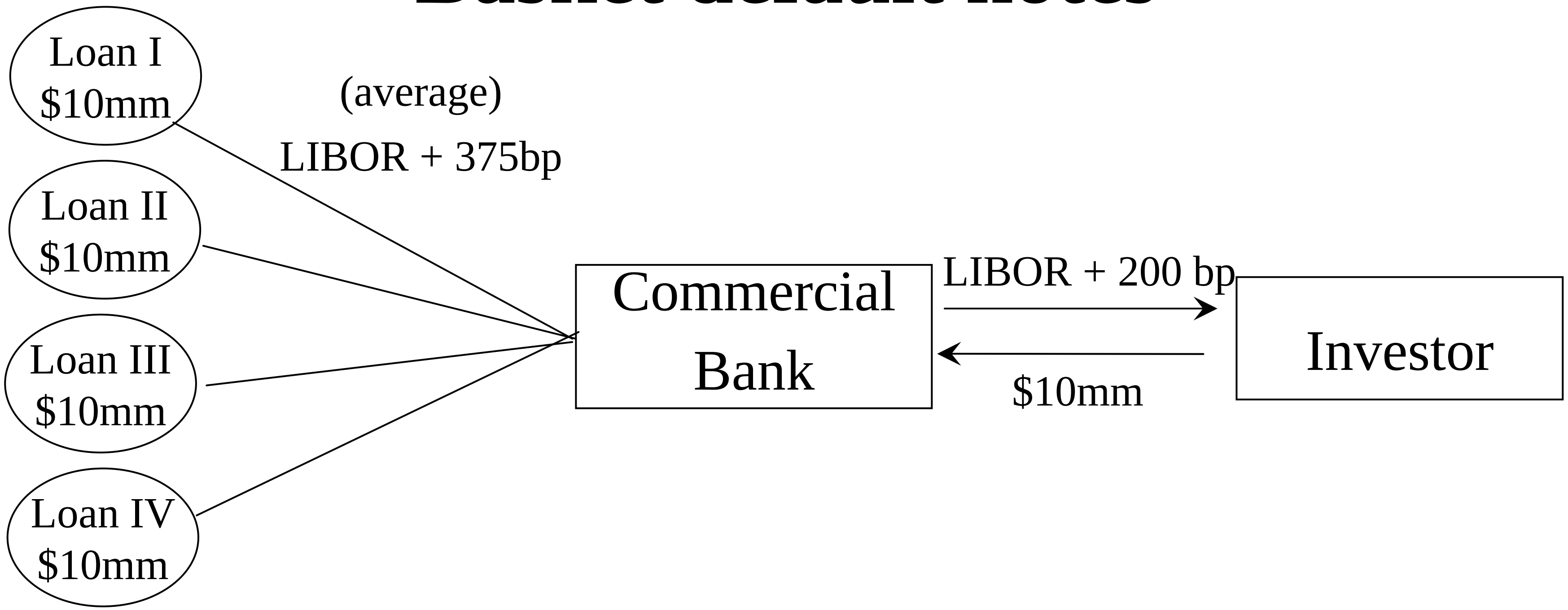
Holder earns an enhanced return for taking on compounded credit-risk – the credit events of a *basket of debts*.

Full principals are returned unless a credit event occurs during the life of the note.

First-to-default structure

In the event of a default of any of the bonds in the basket, the holder redeems the note at par times the recovery rate of the first bond to default.

Basket default notes



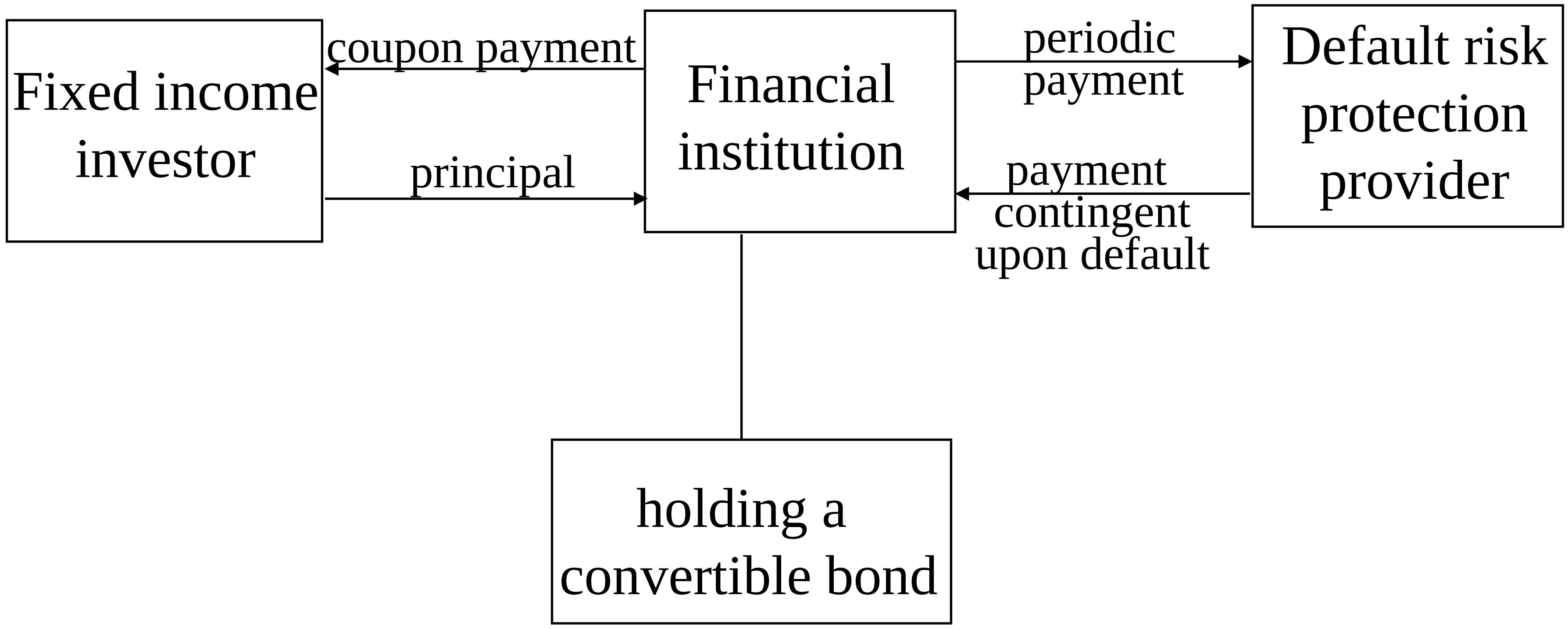
In the event that any of the loans defaults, the note is terminated. The bank keeps the $10 million of note proceeds, and the defaulted loan is put to the investor.

Effectively, the investor bears the *risk of the first default*. However, any subsequent defaults are the sole responsibility of the bank.

Stripping different components of convertible bonds

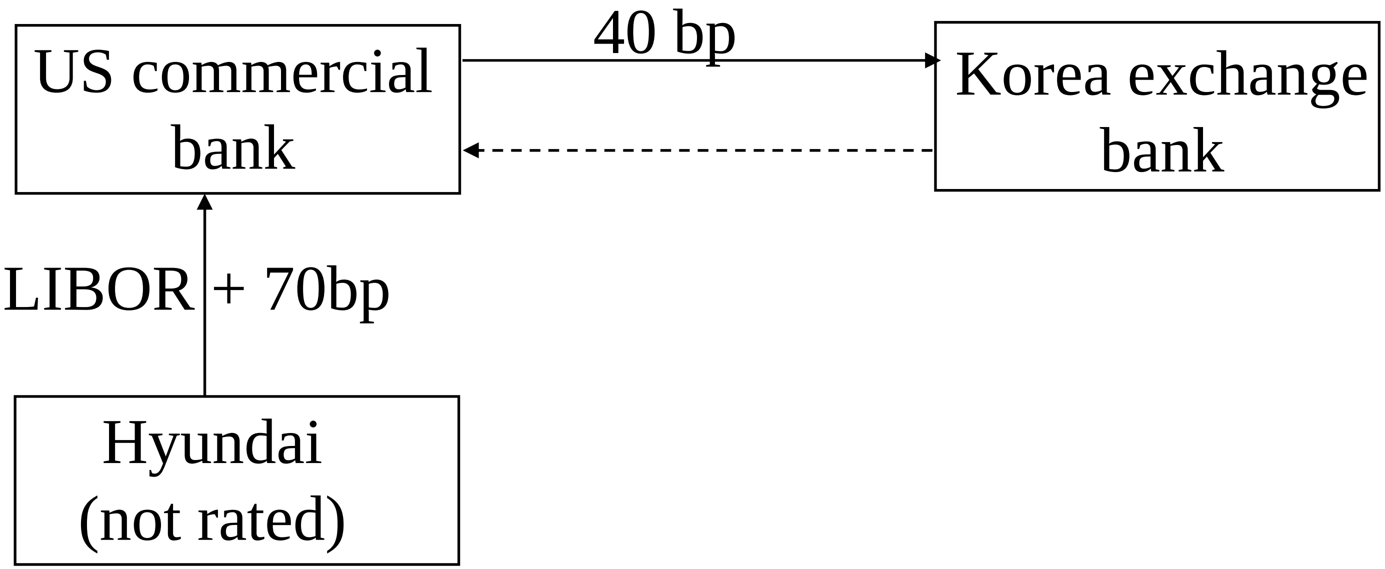
A convertible bond consists of 3 components

- bond component
- equity component
- default risk



Counterparty risk

Before the Fall 1997 crisis, several Korean banks were willing to offer credit default protection on other Korean firms.



* Political risk, restructuring risk and the risk of possible future war lead to potential high correlation of defaults.

Advice: Go for a *European bank* to buy the protection.

Risks inherent in credit derivatives

- *counterparty risk* – counterparty could renege or default
- *legal risk* – arises from ambiguity regarding the definition of default
- *liquidity risk* – thin markets (declines when markets become more active)
- *model risk* – probabilities of default are hard to estimate

Market efficiencies provided by credit derivatives

1. Absence of the reference asset in the negotiation process - flexibility in setting terms that meet the needs of both counterparties.

2. *Short sales* of credit instruments can be executed with reasonable *liquidity* - hedging existing exposure or simply *profiting from a negative credit view*. Short sales would open up a wealth of arbitrage opportunities.

3. Offer considerable flexibilities in terms of *leverage*. For example, a hedge fund can both *synthetically finance the position* of a portfolio of bank loans but avoid the administrative costs of direct ownership of the asset.

Growth is driven by the value created

- Credit risk is inherent in virtually all financial instruments and transactions.

- Quantitative techniques for credit portfolio management are improving.

- Credit markets are inefficient, creating many opportunities to capture value.

- Flexibility in product design to cater all needs.

Emerging market debts contribute the asset class to which credit derivatives can add the most value.

Definition of CDO

A *collateralized debt obligation* (CDO) is an asset-backed security (e.g. corporate bonds, bank loans).

- The funds to purchase the underlying assets (called collateral assets) are obtained from the issuance of debt obligations (also referred as tranches).

It is a ***special purpose vehicle*** that invests in a pool of assets – high-yield bonds, loans, emerging market debts, asset-backed securities, investment-grade bonds etc.

CBO (assets are bonds)

CDO

CLO (assets are loans)

Growth of markets for CDOs

Notional amount of CDO's as rated by Moody's Investors Services

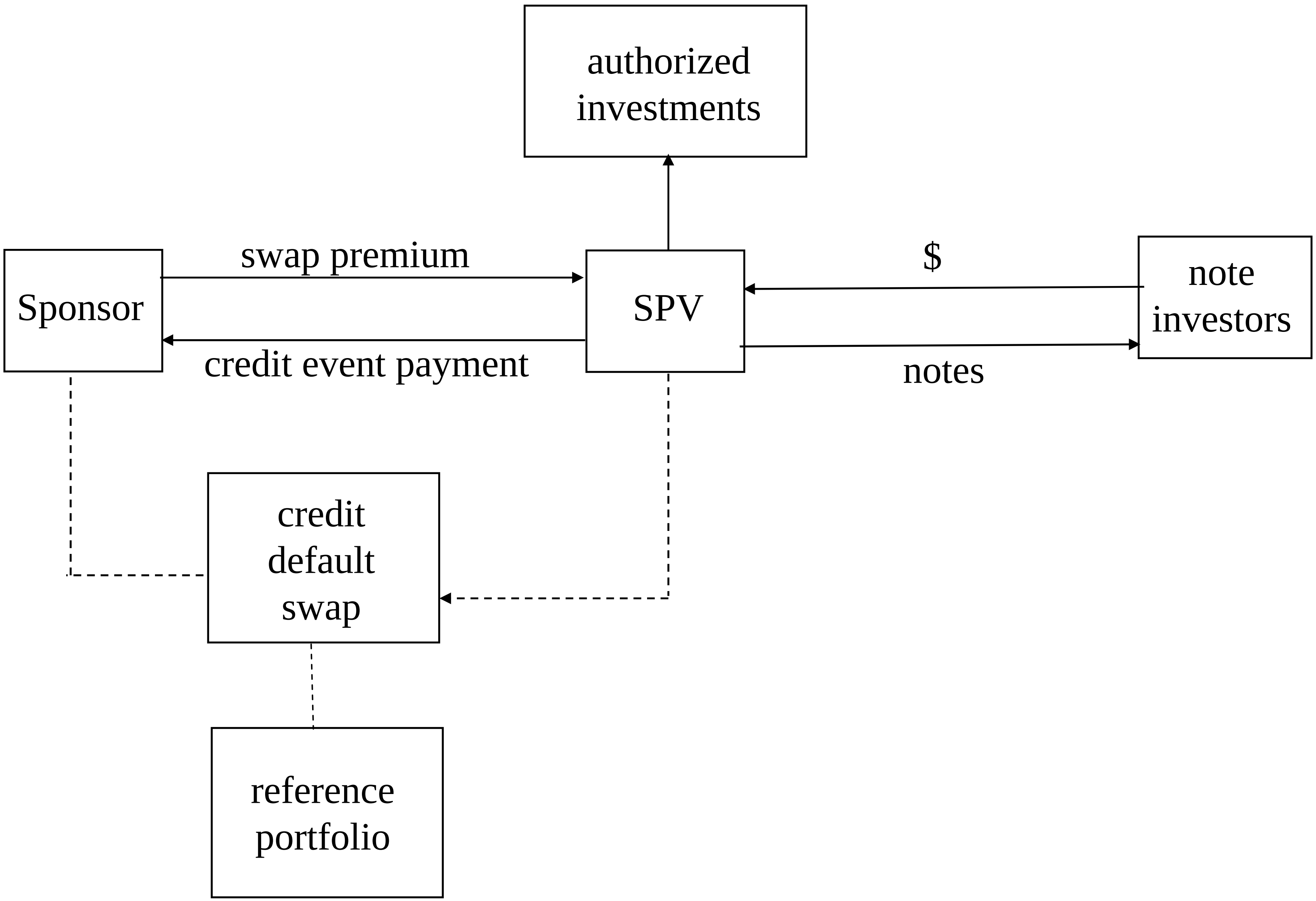
$1 billion in 1995 to $120 billion in 2000

Regulatory wedge – what market requires (economic capital)
and what regulators require (regulatory capital)?

Loans are 100% risk weight items and capital charges of 8% are levied on them.

- Forcing banks to allocate the same quantity of capital to support a loan to an AA-rated company as to a B-rated company. This would bias the investment decision in favor of the B-rated loans.
- Higher regulatory capital requirement leads to lower return on AA-rated loan.

Typical special purpose vehicle (SPV) issuer structure



Risk distillation in synthetic CLO's

Credit risk is distilled from a reference portfolio of loans, then channeled to the credit markets.

- Create a special purpose vehicle (bankruptcy-remote from the originating bank) that issues the credit-linked notes.
- Credit-linked notes will be collateralized by AAA-rated securities, that is, they are the obligations of a fully collateralized SPV.

Moral hazard – asymmetric information

In virtually every synthetic CDO and CLN, the 'buyer' of protection determines whether a credit event has occurred in the reference portfolio. Also the 'buyer' calculates the severity of its losses following a credit event, and how much the SPV will be required to pay under the swap.

Credit linked notes in synthetic CDO

- The interest from the investment grade security and the periodic swap payments received from the default swap payments received from the default swap buyer are passed on to the CLN investors in the form of a yield on the notes.
- The CLN issuer is protected from default risk of the reference asset.
- Higher return for investors without directly getting into credit derivatives market – same as buying a riskless FRN and selling a credit protection through a CDS.
- Conventional stream of cash flows – periodic fix/float coupons and principal at redemption, if no credit events occurs.
- The cash flows are altered upon the occurrence of a credit event experienced by a reference credit.

Olan Enterprises

1. Olan financed its commitment under the junior credit default swap by issuing Eur 180 million of credit linked notes in 4 classes (11% of the reference portfolio). This is a ***partially funded synthetic CDO***. The goal of partial funding is to deliver favorable capital requirement without the funding cost disadvantage problem.

2. Olan used the proceeds from the notes to purchase 5-year French Treasury bonds (OATs) as collateral. Should a reference credit be affected by a credit event, Olan must sell OATs to pay BNP's loss.

3. Olan receives the premium from the junior credit default swap. The fee, plus the coupon the AAA-collateral, funds Olan's interest obligations on the credit linked notes.

Olan 1 Transaction structure

Launched by Banque Nationale de Paris (BNP) in 1999.

BNP

- Owns Euro 1, 635 million of corporate obligations
- Enters into two credit default swaps and pays credit protection fees to swap counterparties

BNP pays credit protection fee (10 bps)

OECD bank will purchase up to 89% of defaulted loans (at nominal value minus market value) after protection offered by junior swap is exhausted.

OECD Commercial Bank

Senior Swap Counterparty

BNP pays credit protection fees (96 bps)

Olan will purchase up to 11% of defaulted loans (at nominal value minus market value)

Olan Enterprises PLC

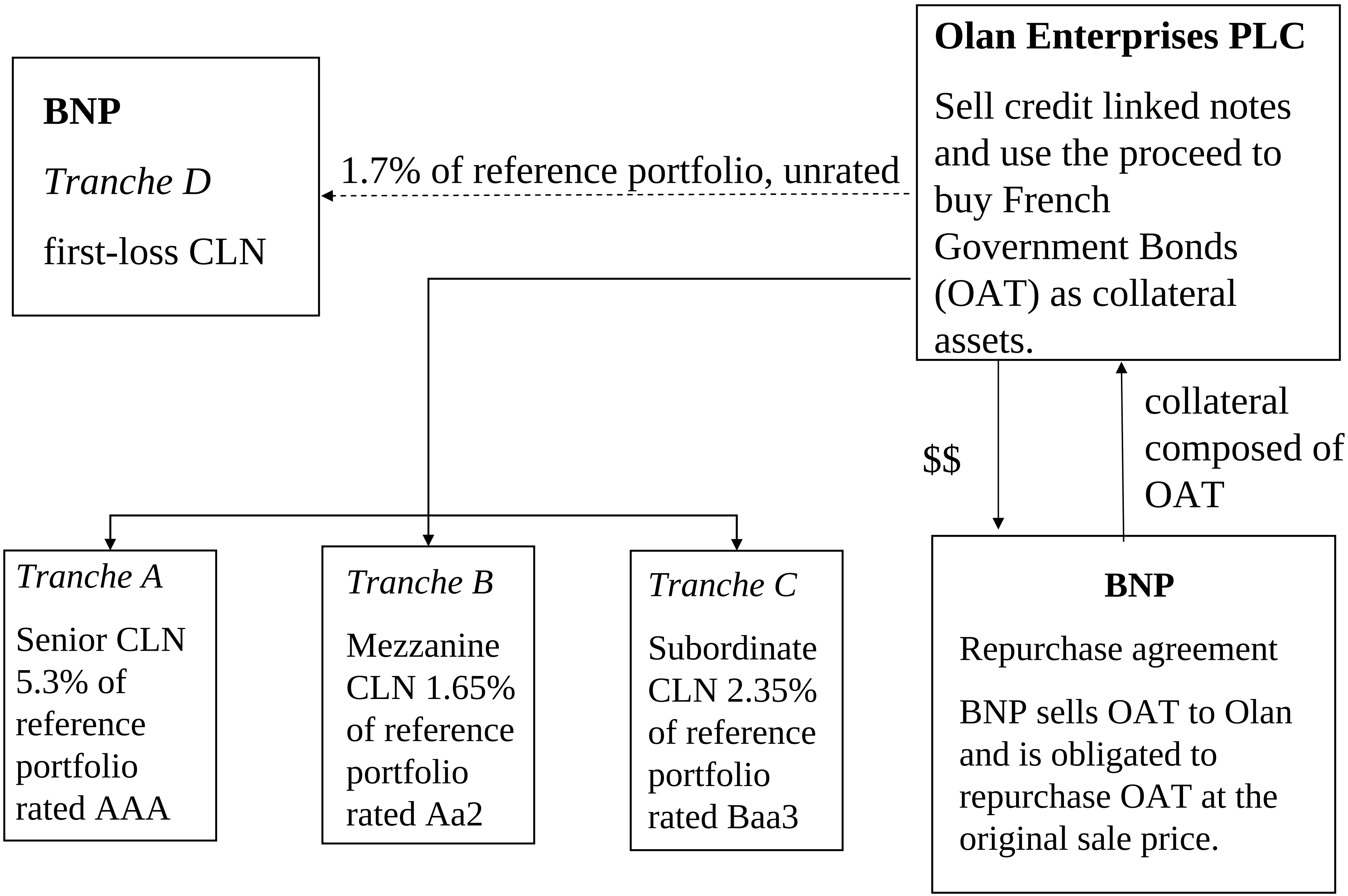
(Bankruptcy-remote SPV)

Junior Swap Counterparty issues Euro 180 million of credit linked notes in 4 tranches

Total premium (as % of reference portfolio) = 0.96% × 11% + 0.10% × 89% = 0.1946%.

Note that 180 million = 1,635 million x 11%.

Olan 1 Transaction structure



Credit linked notes – public issues

	Class A	Class B	Class C	Class D
Amount (Euro)	86.65m	26.97m	38.42m	27.96m
Rating	AAA	Aa2	Baa3	unrated
bp over 3-month Euro-bor	30	40	150	NA
% of corporate credit exposure	5.3%	1.65%	2.35%	1.7%

Class D will absorb the first loss experienced by the reference portfolio. This first-loss CLN was retained by BNP.

Transfer of credit risks

The 4 credit-linked notes have different exposures to credit risk

- Class D funds the first level of losses (retained by BNP)

The credit risk beyond that funded by the SPV is shifted to an Organization for Economic Cooperation & Development (OECD) bank via a *Senior* default swap.

The embedded risks in the reference portfolio of loans are shifted without having to sell the underlying loans – *synthetic CLO*.

OATs as collateral

OATs are used as collateral, first for the credit protection of BNP, then for the repayment of classes A, B, C & D.

Repurchase agreement (mitigate the market risk associated with liquidation)

BNP is committed to repurchase the OATs sold to Olan at the original price paid by Olan.

Reference

1. L.S. Goodman, “Synthetic CDOs: an introduction,” *Journal of Derivatives*, (Spring 2000) p. 60 – 72.
2. C.A. Stone and A. Zissu, “Synthetic collateralized loan obligations: Olan Enterprises, PLC,” *Journal of Derivatives* (Spring 2000) p.73 – 80.

Regulatory capital for synthetic CLOs

Partially funded synthetic CLOs

D = sponsoring bank's first loss (class D retained by sponsoring bank)

20% = risk-weight assigned to the notional amount of the senior credit swap

Senior = notional amount of senior credit swap

K_{fed} = capital requirement for the sponsoring US bank

$= \max(D, 0.08 \times (D + 0.2 \times \text{senior}) + 0 \text{ x junior}) = 1.7\%$

K_{CB} = capital requirement for the sponsoring bank under Commission Bancaire (French banking regulator) regulations

$= D + 8\% \times 20\% \times \text{senior} = 3.124\%.$

Class D as an inverse floater

P = premium on the first call credit default swap = 0.96%

$$P\sum_{i=A}^{D} W_i = \sum_{i=A}^{D} W_i C_i - W_H C_H$$

C_H = coupon from the highly rated security (OATs) = 6.75%

W_A	=	5.3%	C_A	=	Euribor + 30
W_B	=	1.65%	C_B	=	Eurbor + 40
W_C	=	2.35%	C_C	=	Euribor + 150
W_D	=	1.7%	C_D	:	to be computed
W_H	=	11.0%	C_H	=	6.75%

0.0096(0.112) = 0.053(Eur + 30) + 0.0165 (Eur + 40) + 0.0235 (Eur + 150)

+ 0.017 x C_D – 0.11(0.0675)

C_D = 0.4735 – 0.65882 (Eur)