Functional Training & Basel II Reporting and Methodology Review:

Derivatives

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1 Exposure Definitions

1.1 Derivatives

1.1.1 Introduction

Financial derivatives are any positions whereby the value of the positions is determined based on a market movement affecting some other financial instrument or variable. The financial instrument(s) or variable(s) from which a derivative derives its value is called its **underlier(s).**

Derivatives can be used for hedging, protecting against financial risk, or can be used to speculate on the movement of some reference asset or market price.

1.1.1.1 Exchange Traded Derivatives

An important distinction exists for derivative positions that contain credit risk vs. those that do not. The key concept in this distinction is that of a risk counterparty, and, more specifically, identification of those trades in which a derivatives exchange issues a guarantee on performance of a contract, and thus is modeled as the risk counterparty. Exchange-guaranteed contracts are considered to have no counterparty credit risk, and thus are not modeled for credit reporting, but are necessary to track for other regulatory reporting, e.g., TIC-D reports.

Exchange traded derivatives are often leveraged, meaning that only a fraction of an underlying market price is required to purchase the derivative, called an *initial margin*, and the derivative position is "marked-to-market" on a periodic basis, usually daily. The initial margin is meant to represent the maximum amount a derivative could reasonably decline in a single day. Contractual clauses can require the derivative holder to replenish a *maintenance margin* based on an agreed upon floor amount, normally a percentage of initial margin, e.g., 75%. If market movements cause the value of the contract to move below the maintenance margin floor, a margin call is made by the seller of the derivative, and the purchaser must replenish funds equal to the amount of the initial margin. As such, the margining process is intended to insulate the exchange from credit risk. If the buyer does not comply with a *variation margin* call, the seller can liquidate, or close out, the position, incurring a loss equal to the difference between the current market price of the derivative and the previous marked-to-market price plus the remaining margin minus transaction costs, as follows:

((market price – previous marked price) + remaining margin – liquidation costs)

For instance, assume a drastic 2 day drop in an equity price from 10.35 to 10 and then from 10 to 8 in a long equity futures contract. If initial margin is 15%, and maintenance margin is 75%, the maintenance margin would not be breached on the first day, but would on the second day, and a variation margin call would be made by the exchange. If the margin call is not met by the counterparty, the exchange will liquidate the position. Assuming liquidation costs of .5%, the exchange would incur a loss equal to ((8-10) + 1.2025 - .05) = $-.8475 per share after liquidation. Because of the margining process, only drastic swings in market prices (as above) create credit risk for an exchange.

1.1.1.2 Over-The-Counter Derivatives

Conversely, over-the-counter (OTC) derivatives are contracts traded directly between two parties, without going through an exchange or other intermediary. Products such as swaps, forward rate agreements, and exotic options are always traded in this way. Because no guarantee is offered by an exchange, these trades carry counterparty risk and are modeled for both regulatory and economic credit risk.

The credit risk in OTC trades can be bucketed into two categories: pre-settlement and settlement risk.

1.1.1.2.1 Pre-Settlement Risk

Pre-settlement risk is the risk associated with the counterparty becoming insolvent on the cash flow payments that are due prior to the final settlement of the contract at the expiration date. The exposure in this case is equal to the counterparty's net obligation on that contract, rather than the gross obligation. In other words, if the contract is terminated before its scheduled termination, pre-settlement risk constitutes the difference in the market value of the derivative and its agreed contractual price. A useful measure of this type of exposure is the current replacement cost (called mark-to-market exposure), which can be translated as the current cost to an institution of having to completely replace all contracts based upon those contracts' current market values, in case of a counterparty's default. Hence, a contract seller will only incur a pre-settlement replacement cost loss if there is a coincidence of events: an adverse change in the underlying market price (mark-to-market gain for seller), combined with a default by that counterparty.

1.1.1.2.2 Settlement Risk

Settlement risk, on the contrary, can be defined as the risk a bank faces when it has performed its obligations under a contract, but has not yet received value from its counterparty. In short, this risk entails a cash or physicals flow by one, but not both, parties in a contract. The time horizon for settlement risk is typically very short but might be as long as 46 days or more, which incurs severe risk weighting under Basel II regulatory capital rules. A classic example of foreign exchange settlement risk is the failure of Germany's Herstatt bank. On June 26, 1974, Herstatt had taken in all its currency receipts in Europe but had not made any of its US dollar payments when German banking regulators closed the bank down at the end of the German business day. Counterparties were left holding unsecured claims against the insolvent bank's assets. Consequently, settlement risk is sometimes called Herstatt risk. Herstatt collapse was one of the primary facilitators of the Basel I accord.

Specifically for FX settlement risk, a bank was set up by leading trading banks, with the support of central banks and the BIS (Bank for International Settlements), to settle foreign exchange transactions on a global basis. CLS, or Continuous Linked Settlement, is designed to remove the Herstatt Risk of default by one party in a foreign exchange deal.

For some types of trades, e.g., futures, there are defined procedures or an intermediary, such as a clearinghouse, to handle, and thus eliminate, settlement risk, and can also be settled prior to expiry without physical exchange. Other trade types, such as forwards, require physical delivery of an asset, introducing settlement credit risk if one party performs but the other does not. Under the Basel II rules, all assets that are subject to settlement risk must be categorized as unsettled transactions.

1.1.2 Common Definition

The matrix of common derivative types and associated credit risk exposure (exchange traded = market risk vs. OTC = market + credit risk) is as follows:

Table 1 – Derivative Type by Counterparty

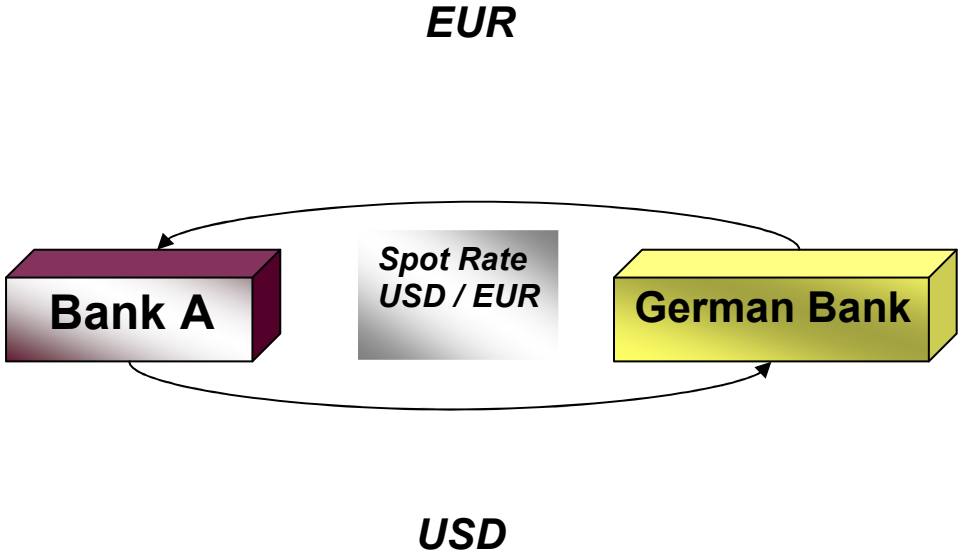
Common Derivative Definitions	Type of Counterparty: Exchange	Type of Counterparty: OTC
Futures	✓	
Forwards		✓
Options	✓	✓
Swaps		✓
Spot		✓
Complex Derivatives		✓

Further, definitions of these common derivative types are as follows:

1.1.2.1 Spot

Although often categorized as derivatives, spot, or cash, trades really take on the credit characteristics of direct security purchases and sales, since the value of the contract is set at time of purchase, and the credit risk that arises is based on settlement risk, i.e., one party doesn't perform its end of the contract and the exposure is based the value of the instruments not received. Spot or cash trades can assume this risk profile in cases where the settlement takes place days (usually 2 to 5 days) after the date when the market value of the trade is determined, therefore giving rise to counterparty and market risk.

Graphical Example of FX Spot



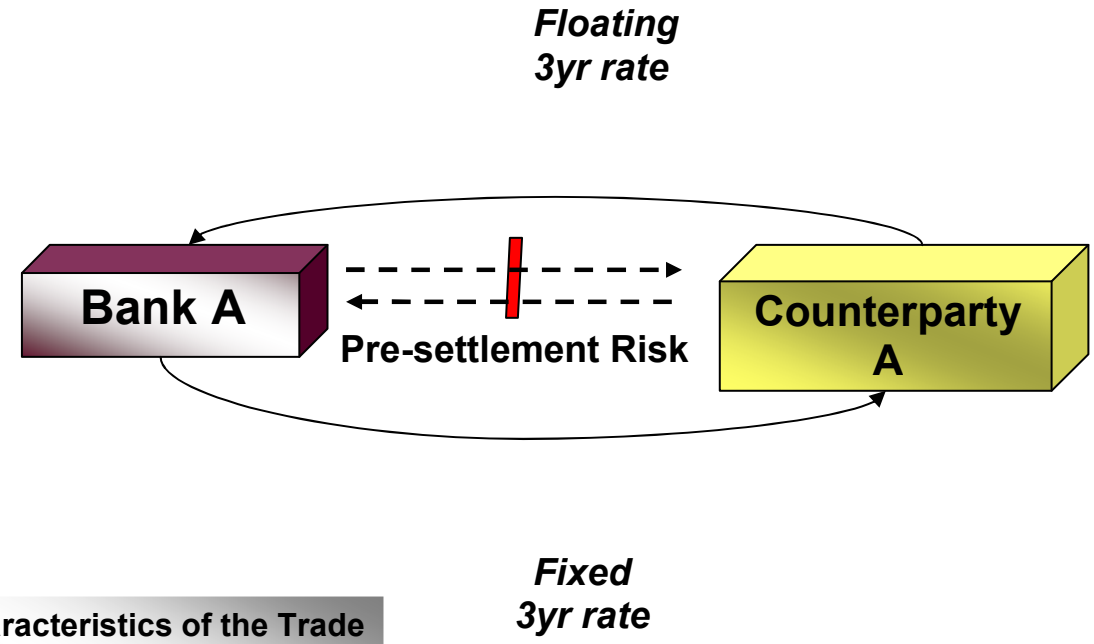
The example above shows an operation where Bank A enters into an agreement with a German Bank to pay American Dollars in exchange for Euros on spot. Even though the transaction is negotiated and the rates are agreed upon in the same day, the final settlement takes on average two to three days after trade date. In this short period of time, risk arises that the German Bank will not honor its obligation, therefore creating credit risk.

Note that a CLS-governed transaction practically eliminates settlement risk. However, pre-settlement risk still exists that the counterparty could become insolvent between the trade and settlement dates.

1.1.2.2 Swaps

Swaps are financial contractual agreements where two counterparties exchange one stream of cash flows against another stream. These streams are called the *legs* of the swap. The cash flows are calculated over a notional principal amount.

Graphical Example of IR SWAP Pay Fixed



*In the example above, Bank A enters into a contract to exchange semi-annual payments over a Notional amount of $10,000,000 with a certain Counterparty A. Bank A will pay a fixed rate applied over the notional amount every six months to Counterparty A, whereas counterparty A will pay a variable rate to Bank A. In reality, in these transactions the notional amounts are not exchanged and the payments are made based on the differential of the current variable rate vs. the fixed rate of equal maturity. In other words, Bank A will only make the semi-annual payment when the floating rate that it agreed to receive falls below the fixed rate it agreed to pay. On the other hand, if the floating rate rises above the fixed rate, the counterparty is obligated to pay whatever the differential in the rates is times the notional amount to Bank A, a positive marked-to-market amount that creates pre-settlement credit risk. For simplicity sake, let us say that the fixed rate agreed upon is 5% and that at a certain scheduled payment date the variable rate is 6%, in this case a possibility arises that the counterparty will not pay the 50,000 it owes to Bank A at that payment date (10,000,000 * (6% - 5%)*.5)*

1.1.2.3 Options

Options are contracts that give the buyer the right (but not the obligation) to buy (call options) or sell (put option) an asset at a specific rate on a pre-determined expiration date in a pre-set notional amount. The one exception to this rule: interest rate Caps and Floors, which pay out regardless of an option exercise,

but are priced like any other option. Options can be traded over-the-counter or on a derivatives exchange. Most exchange-traded options have stocks or futures as underliers. OTC options have a greater variety of underliers, including bonds, currencies, physical commodities, swaps, or baskets of assets.

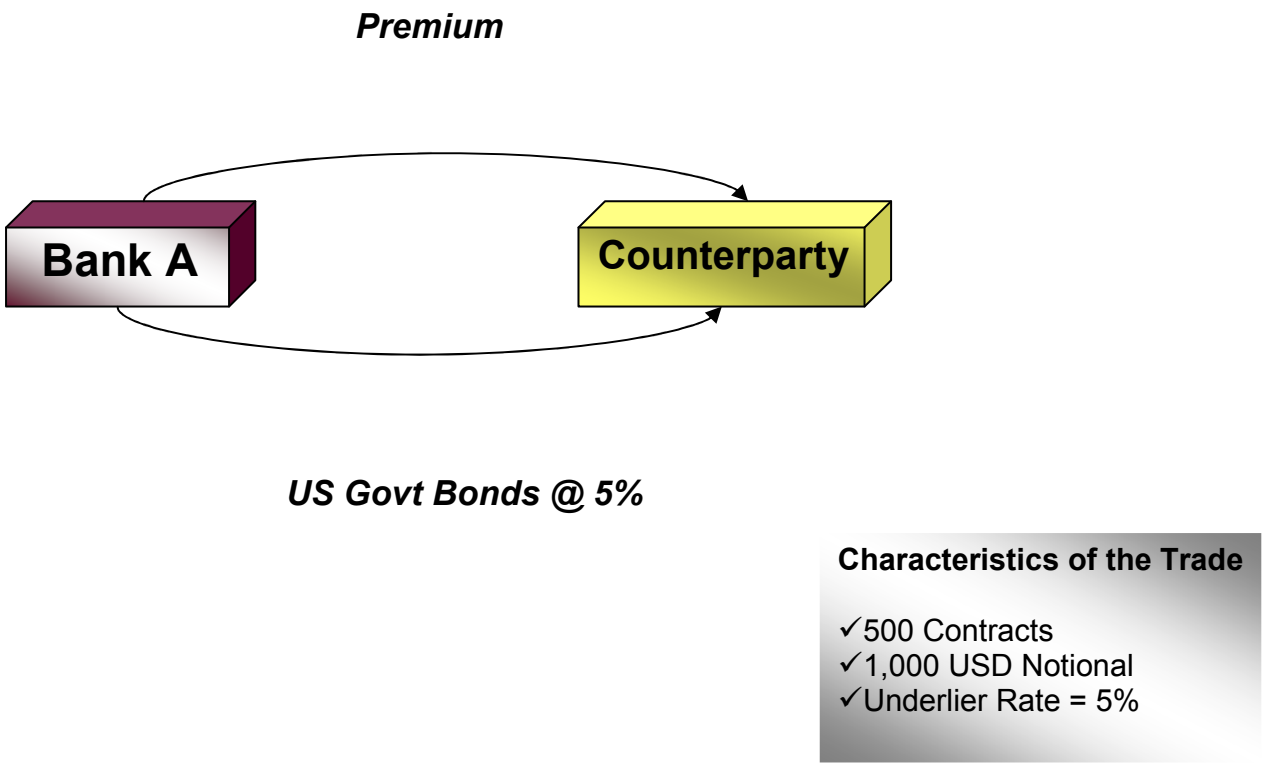
Options may allow for one of three forms of exercise:

- American exercise: the option can be exercised at any time up to the expiration date.
- European exercise: the option can be exercised only on the expiration date.
- Bermudan exercise: occasionally used in OTC transactions, the option can be exercised on a few specific dates prior to expiration. The name was chosen because Bermuda lies between America and Europe!

Since American and Bermudan options can be exercised at dates earlier than the expiration date, they tend to carry more value for the purchaser and therefore be priced higher than European options.

European options can be structured in series to constitute guarantees, namely, caps and floors. The objective is to protect lenders from sharp drops in interest rates and borrowers from a sudden rise in financing costs. Usually, these are used as part of a strategy called Collar, which protects counterparties from extreme volatility in interest rates or foreign exchange rates.

Graphical Example of OTC IR Option Bought (Put)

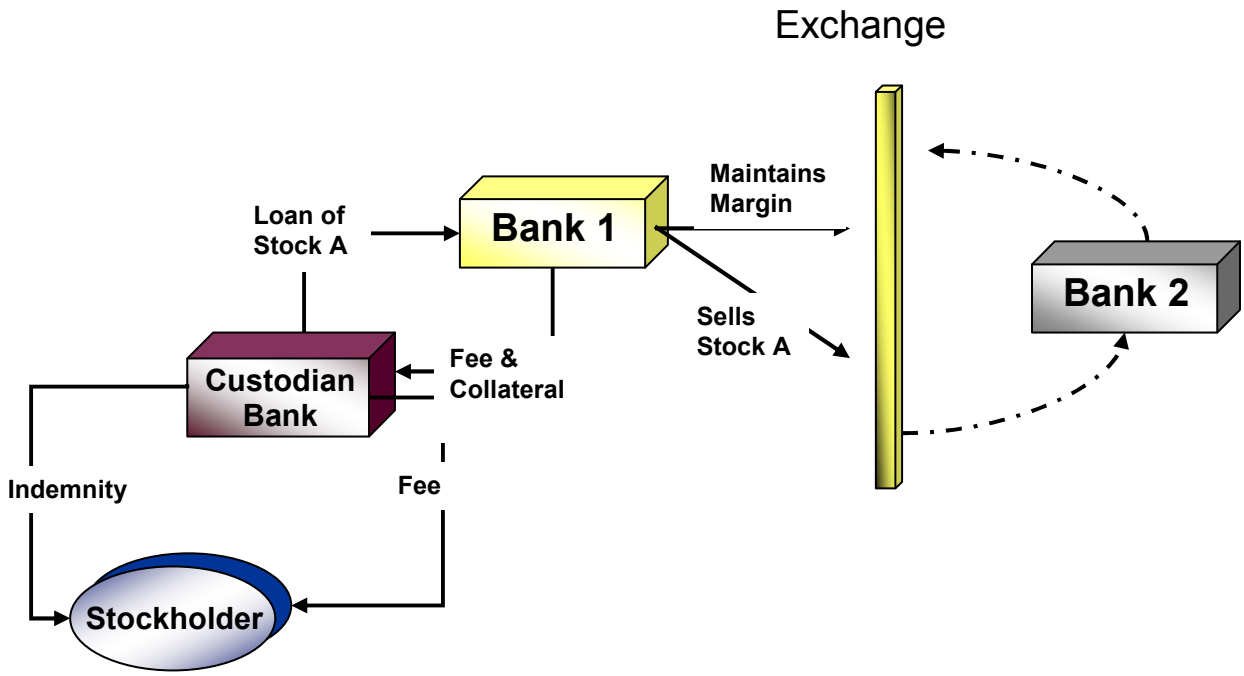


In the example above the Bank A purchased the right sell 500 government securities indexed at a fixed rate of 5% USD Libor for $2 dollars each (par value) at the expiration of the option. The bank will only exercise the option if interest rates (USD Libor) rise above 5%, in which case it would be profiting since the adjusted price of the underlying securities based on the new interest rate would be lower than $2 (the par value). When this scenario happens the option is considered 'in the money'. When the option is in the money the (credit) risk arises that the counterparty will not honor its obligation to purchase the contracts for the agreed $ 1,000 dollars.

1.1.2.4 Future

Future contracts are an exchange-traded obligation to buy or sell a financial instrument or to make a payment at one of the exchange's fixed delivery dates, the details of which are transparent publicly on the trading floor and for which contract settlement takes place through the exchange's clearinghouse.

Graphical Example of Securities Lending and a Short Future (Equity)

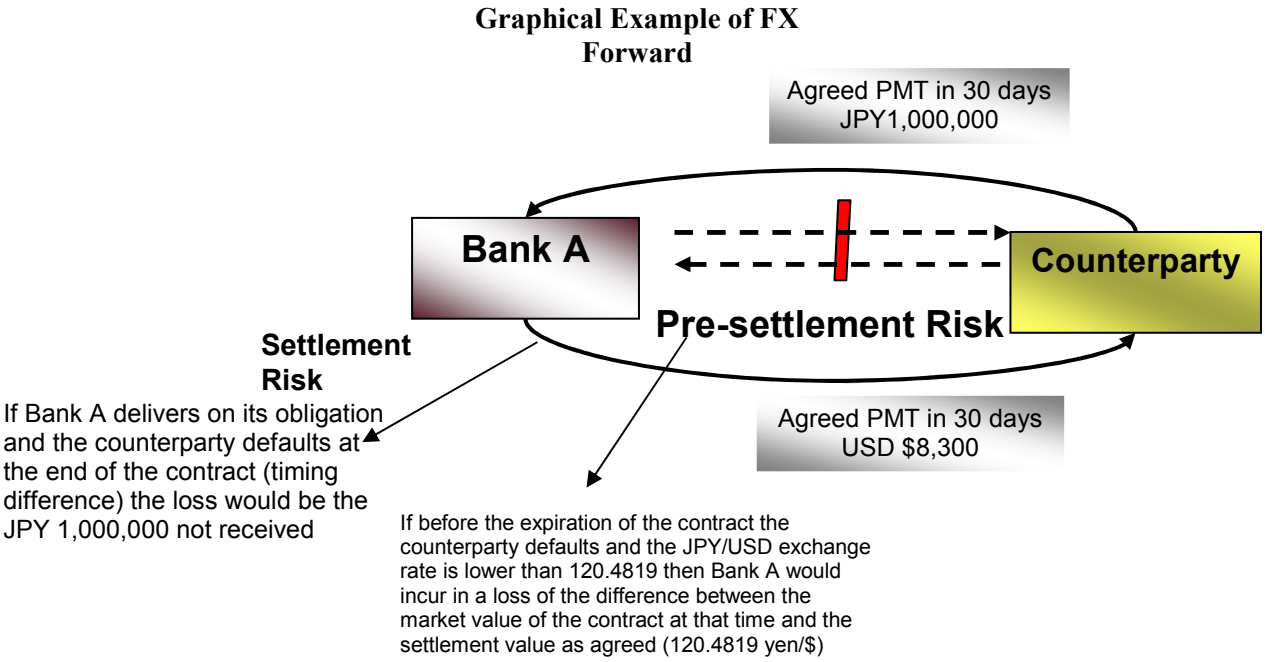


The example above portrays a situation where the custodian loans stock A to Bank 1, which in turn enters into a future agreement to sell the stock via a Derivatives Exchange. Bank 2 remains 'invisible' to Bank 1 and the custodian, as its counterparty risk is assumed by the exchange. In return for the stock loan, Bank 1 pays fees to the custodian, a portion of which is returned to the stockholder, and posts collateral. At the expiration of the contract, Bank 1 has to go to the market, purchase the stock A and return it to the custodian. The credit risk in the transaction is driven by the probability that Bank 1 won't return the stock it sold to Bank 2, and the price of the stock has risen above the value of collateral on hand. (This concept will be discussed in detail in the Repo-Style section) Note that if the custodian were taking the role of Bank 1, its credit risk in the futures transaction is eliminated because the operation is guaranteed by the exchange.

The stocks loaned are usually clients' stocks that are retained in custody and can be managed via the asset management division of a bank. For allowing the custodian to lend their stocks, the stockholders receive both a fee and an indemnity. This arrangement between the custodian and Bank 1 is referred to as 'securities lending' and constitutes a sizable business.

1.1.2.5 Forward

Forwards are an over-the-counter obligation to buy or sell a financial instrument or to make a payment at some point in the future, the details of which are settled privately between the two counterparties. Forward contracts generally are arranged to have zero mark-to-market value at inception, although they may be off-market. Contrary to futures where a trade can be performed to offset the physical delivery of the assets, in the forward market the goods must be delivered at the expiration of the contract.



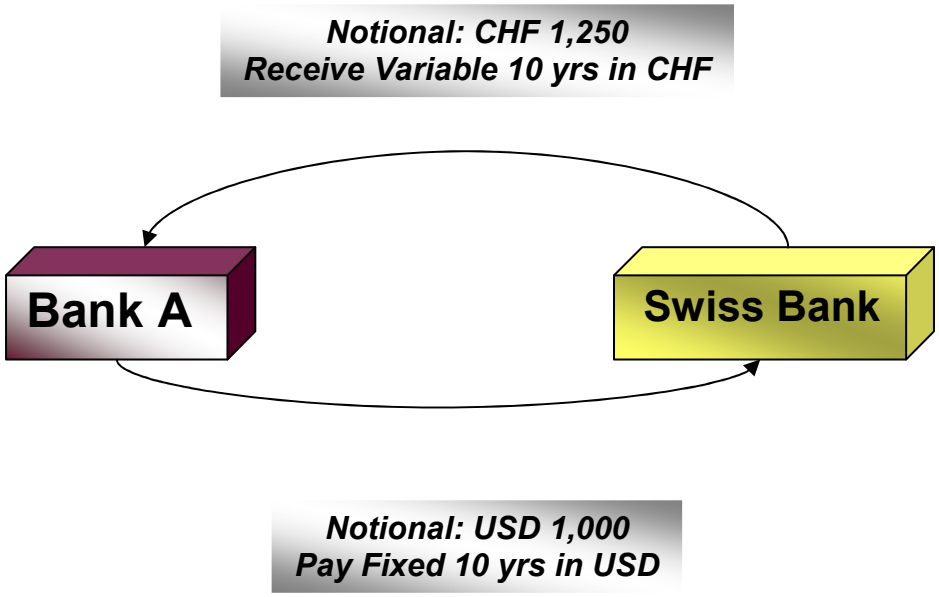
In the example above Bank A enters in a forward agreement with a counterparty without any intermediation from an exchange to deliver 8,300 dollars in exchange for 1,000,000 yen in 30 days. The main source of credit risk for the Bank A is the counterparty's defaulting on its obligation when the settlement date arrives while Bank A, on the contrary, honors its part of delivering the $8,300. This risk is modeled when a timing difference exists between each cash flow in the transaction (one party has performed but the other hasn't at close of business), either before or after settlement date. In this case, the bank would model the risk of losing the 1,000,000 yen owed to it. Again, this risk is mitigated if the transaction is governed by the CLS bank.

Another source of risk is the occurrence of a triggering event before any payments are exchanged in which case the counterparty would default prior to expiration and Bank A would have to go to the market and replace the contract(s). The risk only becomes relevant if the current market rates are less favorable to the Bank A than those inherent to the contract terms.

1.1.2.6 Exotics

Complex Derivatives are specialized trades where more than one derivative modality assumes the form of one trade. Characteristic examples are swaptions and cross currency swaps. The first trade is a swap with an inherent option which allows the counterparty the flexibility to activate the SWAP by exercising the option, whereas the latter represents an exchange of interest rate cash flows denominated in two different currencies.

Graphical Example of Cross Currency Swap



In the example above Bank A engages in a contract to receive variable interest rate in Swiss franks for a period of 10 years over a notional of CHF 1,250. On the other hand, it commits to pay fixed interest rates in dollars over a notional of USD 1,000. This transaction is usually performed when Bank A wants to hedge a foreign currency interest rate exposure it holds on the Liability side of its Balance Sheet. This operation entails credit risk since the counterparty can default at any of the scheduled payments. The value of the contract is influenced by both currency and interest rate movements.

1.1.3 Management Reporting Categorization

Management reporting categories normally focus not on the common definition of derivative trade types (future, forward, etc.), but rather the categorization of the asset or market price that underlies the contract. These categories include the following: currency, interest rate, equity, credit derivative, and commodity.

A matrix of the relationship between common derivative definitions and management reporting categorization is listed below, with check marks indicating exposures that actively trade in the marketplace.

Table 2 – Matrix of exposures by Derivative Definitions and Management Reporting Category

Common Derivative Definitions	Management Reporting (Underlying Assets)				
	FX	**IR**	**EQ**	**Commodities**	**CR**
Futures (Exchange traded)	✓	✓	✓	✓	
Forwards (OTC)	✓	✓	✓	✓	
Options (Exchange traded and OTC)	✓	✓	✓	✓	
Swaps (OTC)	✓	✓	✓	✓	✓
Spot (OTC)	✓			✓	
Complex Derivatives	✓	✓	✓	✓	

Definitions of the management reporting categories are as follows:

1.1.3.1 Currency (FX)

Currency derivatives are contracts priced based on the exchange rate between two or more currencies. For instance, an FX forward contract arranges for the exchange of one currency for another based on an agreed upon forward exchange rate. As the market spot exchange rate between the two currencies in question fluctuates, so does the value of the forward contract (remaining term to contract expiration also affects contract value).

1.1.3.2 Interest Rate (IR)

Interest rate derivatives are contracts priced based on a prevailing interest rate(s), in a single or multiple currencies (cross currency swaps). Spot interest rate movements influence the value of the derivative contract.

1.1.3.3 Equity (EQ)

Equity derivatives are contracts priced based on a prevailing market price for a public equity security. Changes in the publicly traded market price of the equity security influence the value of the derivative contract.

1.1.3.4 Commodity (CO)

Commodity derivatives are contracts priced based on the prevailing market price of an underlying raw material, such as gold, wheat, or pork bellies. Changes in the market price of the commodity influence the value of the derivative contract.

1.1.3.5 Credit Derivative Reference Asset (CDRA)

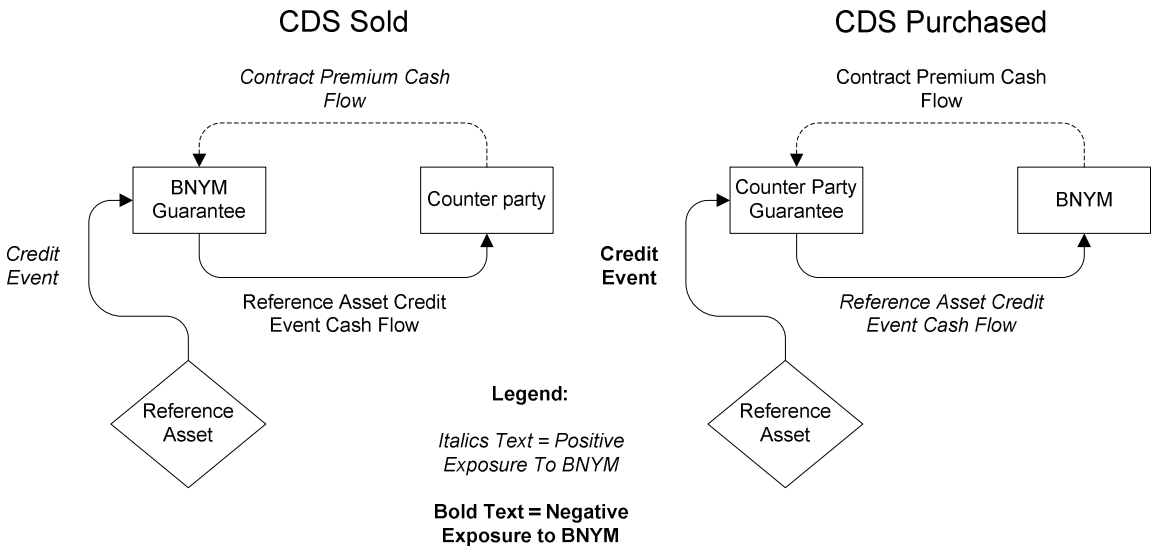
Credit derivatives are contracts priced based on the credit quality of some reference asset, normally a bond rated by an acceptable ratings agency (e.g. Moody's, S&P), representing the credit quality of its issuer. The value of the credit derivative fluctuates based on the probability of a credit event, e.g., credit rating downgrade, as specified in the contract. For instance, if a credit default swap (CDS) specifies a payout based on a full "letter" downgrade by Standard & Poor's against a reference bond, the value of the swap contract to the purchaser increases as the credit quality of the bond issuer deteriorates, and hence the probability of the downgrade increases.

The credit modeling aspects of reference asset risk in credit derivatives depend on whether the credit derivative was purchased or sold. Purchased credit derivatives are mitigants for reference asset modeling, offsetting a credit risk on some portion of the balance sheet (either trade-specific or across the hedged counterparty relationship), while sold credit derivatives are credit risk additive for reference asset modeling. Moreover, selling a credit derivative exposes the seller to the credit quality of the reference asset, based on the payout terms of the contract.

1.1.3.6 Credit Derivative Counterparty (CDP)

Credit risk in credit derivatives is also modeled based on the credit quality of the counterparty in the trade. The purchaser of a credit derivative, specifically a CDS, has exposure to the counterparty in the trade should an eligible credit event occur and a payout by the counterparty is triggered. The seller of a CDS has exposure to its counterparty through the upfront or staggered series of contract premium payments. Other forms of credit derivatives, e.g., total return swaps, have settlement counterparty risk.

A visual representation of both forms of credit derivative risk is illustrated below:



1.1.3.7 Cross Product Mitigation

Credit risk can also be assessed across products, if mitigants, such as netting agreement documents, permit such treatment. The net position, after application of mitigation, is modeled, which might represent derivative positions in multiple product types (FX, IR, EQ, etc.) within a customer relationship. A cross-product exposure calculation should qualify for the Internal Models Methodology calculation approach under Basel II.

1.1.4 Basel II Pillar I Reporting Categorization

The Basel II Accord requires specific disclosure of exposures within the FFEIC 101 report. The taxonomy of disclosure includes four primary drivers: *counterparty, product, calculation method, and exposure status*. One of these four drivers will categorize every exposure for reporting under Pillar I requirements. The method for assigning an exposure category will depend on prioritization rules, with exposure status dominating calculation method, calculation method dominating product, and product dominating counterparty. All derivatives should be categorized by either calculation method or exposure status, with FX, Equity & Commodity trades receiving exposure status treatment via the Unsettled Transactions category if the contract has expired/trade has executed and both counterparties have not performed under the agreement.

1.1.4.1 OTC Derivatives: Cross Product Netting & Collateral EAD adjustment

This exposure category includes all Over-the-counter derivatives (known counterparty) that adjust EAD based on an eligible netting agreement that cuts across product types, including either derivative or repo-style products, or both. Any pledged collateral will also influence the calculation of EAD as a deduction with appropriate collateral haircuts. Please note that collateral does affect the EAD calculation in some Economic Models.

1.1.4.2 OTC Derivatives: Cross Product Netting EAD & Collateral LGD adjustment

This exposure category includes all Over-the-counter derivatives (known counterparty) that adjust EAD based on an eligible netting agreement that cuts across product types, including either derivative or repo-style products, or both. Any pledged collateral will influence the assignment of the LGD rating.

1.1.4.3 OTC Derivatives: No Cross Product Netting & Collateral EAD adjustment

This exposure category includes all Over-the-counter derivatives (known counterparty) that do not apply the effects of cross-product netting, whether present or not, but may apply within-product netting agreements, to adjust the EAD amount. Any pledged collateral will also influence the calculation of EAD as a deduction with appropriate collateral haircuts. Please note that collateral does affect the EAD calculation in some Economic Models.

1.1.4.4 OTC Derivatives: No Cross Product Netting & Collateral LGD adjustment

This exposure category includes all Over-the-counter derivatives (known counterparty) that do not apply the effects of cross-product netting, whether present or not, but may apply within-product netting agreements, to adjust the EAD amount. Any pledged collateral will influence the assignment of the LGD rating, but collateral can be present and ignored for modeling purposes and still fall under this category.

1.1.4.5 Unsettled Transactions

This exposure category includes all transactions that are subject to normal settlement periods (usually up to five days), and have not settled at the end of the trade date or contract expiration. Specific capital calculations apply to these transactions, and should be the first priority in categorization. Within the derivatives realm, FX, equity, and commodity transactions can fall within this category. Direct investment in securities can also incur settlement risk and are categorized as unsettled transactions, if applicable. Within the Unsettled Transactions FFEIC 101 category, capital calculations are driven by identification of positions as Delivery vs. Payment, Payment vs. Payment, or non-Delivery vs. Payment/non-Payment vs. Payment.

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