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Being Paper Delivered - Dr Ikpefan, O. Ailemen At ReCh Management Centre, 23rd June, 2016

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Course Title: Derivatives/Finance for Non Finance Managers/Global Treasury Management

Session Facilitator: Ikpefan, O. Ailemen Ph.D, FCA, FCIB,ACSI, FNIM

Objectives

At the end of this course delegates will be able to understand the following:

Module One

The use of derivatives to manage risk – Introduction to options, Spot Foreign Exchange, Foreign exchange Swaps, Foreign currency Options, Interest Rate Swaps, Interest Rate Options (IRO), The effective use of derivatives, swaption, Zero-coupon rates and forward-forward rates and valuing interest rates swaps

Module Two

Interest Rate Risk: Gap analysis – types and use and worked examples, terminology and pricing, interest rate management strategy, interest rate swaps, futures.

Essential Reading:

Osuoha, John (2010), Commodity Trading & Futures Emma Esth, Lagos

Pre-reading:

Brigham, E.F and Daves, P.R. (1980), *Intermediate Financial Management*, Mason, South-Western, Pg. 658.

Further reading

Pandey, I.M (2002): Financial Management, Vikas Publishing House PVT Ltd, New Delhi

MODULE ONE

DERIVATIVES

Futures and Options are derivatives. Derivatives is an instrument whose value is derived from the value of another financial instrument(s).Derivative is another means of investing in the instruments from which the derivative is derived. Because, the values of derivative securities are contingent/dependent on the value of the underlying instruments, they are regarded as contingent securities.

Just like orange juice is derived from oranges, Apple juice is derived from Apple, mangoes juice is a product from mango etc. Derivative securities are derived from some basic instruments like shares, stocks, commodities etc. Derivative instruments do not generate cashflows themselves. They derive their cashflows and risk characteristic of the underlying securities.

UNDERLYING SECURITIES

They are conventional, original or primitive instruments from which derivative securities derive their value. They include:

(1). Shares (2)Stocks (3)Bonds (4)Commodities (5)Currencies (6)Interest rate (7) Treasury Bills/Bonds (8) Stock Index (9) Oil &Gas (10) Real Estate (11) Agricultural Product (12) Precious Metals (13) Emissions (14) Weather (15) Credit (16) Plastics (17) Power (18) Freight (19 Scrap and second items (20) Energy etc

The Role of Derivative Market

1. **Risk Management –** Derivative enable investors wishing to transfer their risk to those willing to accept it**.**
2. **Price Discovery –** Derivatives help investors in obtaining information about future prices. Some people even believe that the price of futures and forward contract will likely be the future spot rate.
3. **Market Completeness –** In a derivative market, all identifiable pay –offs can be obtained. It is possible to trade in all securities available in the market over those derivable.
4. **Speculation –** Provides opportunities for knowledgeable traders to expose themselves to well calculated risk in pursuit of big profit.

5. **Market efficiency –** The ease and low cost of transacting in the derivative market facilities arbitrage trading and rapid price adjustment.
6. **Operational Efficiency** – Derivative markets offer lower transaction cost, greater liquidity than spot markets, low capital required for investments, risk and return can be adjusted to desired level etc.
7. **Achieving Leverage** – Derivative market is used to achieve greater leverage. Traders in the derivative market use a small amount of money to make an investment of much greater value. Also a small price change changes can lead to large gains and losses.

ADVANTAGES OF DERIVATIVES

1. Transaction costs are lower
2. Transactions are for faster and/or easier because of better market liquidity than the underlying instrument.
3. The risk profile of a portfolio can be easily changed
4. Short selling is possible – i.e one can sell what he does not have.
5. It is possible to invest in a whole basket of stock by buying an option on a stock index. It will be much more costly to buy the basket of stocks directly.
6. Derivative put no additional risk into the economy, they merely allow risk to passed from one investor to another.
7. It can be used to achieve greater leverage
8. Useful in asset allocation

PROBLEMS OF DERIVATIVES

1. Derivative is like electricity, it becomes very devastating if it is misused or misapplied or if its users become careless.
2. Because of high leverage, little changes in price can lead to large amount of losses (an also gains).
3. Some argue that derivative market siphon capital into mainly speculative schemes. This argument cannot hold when you realize that unlike the financial markets derivative markets neither create nor destroy wealth they only transfer it.
4. Using derivatives without having the required knowledge is dangerous. It’s risking to speculate when one should be hedging and so on and so forth.

5. Derivatives are still very abstract in Nigeria and developing countries. Derivative instrument are not still available or are still developing. No well established derivative exchange.
6. Derivative is sophisticated instruments and their use requires good understandings of finance/finance engineering.

TYPES OF DERIVATIVE INSTRUMENTS

There are three basic types of derivative instruments:

Namely:

1. Futures
2. Options
3. Swaps

Others include

(4) Forward (5) Warrants (6) Right (7) Convertibles (8) Caps (9) Floors (10) Collars

FUTURE S CONTRACT

A future contract is an agreement that requires a party to the agreement either to buy or sell an asset at a designated future date at a predetermined price. The basic economic function of futures market is to provide an opportunity for market participants to hedge against the risk of adverse price movement.

USES OF FUTURES CONTRACT

Future contract are used for:

(1).Speculation purpose (2) Hedging purpose (3) Risk transfer (4) Adjusting the duration of a bond (5) Achieving greater leverage (6) Investing future cash (7) Changing asset allocation (8) Arbitraging

LIQUIDATING FUTURES POSITION

A party to a future contract has two choices on liquidation of the position

(1) OFFSETTING A FUTURE POSITION

The position can be liquidated prior to the settlement date. For this purpose, the party must take an offsetting position in the same contract. For the buyer of a future contract, it means

selling the same number of identical futures contracts and for the seller of a futures contract it means buying the same number of identical futures contract

(2) DELIVERY AND SETTLEMENT

The alternative approach is to wait until the settlement date. At the settlement date the party purchasing a futures contract accepts delivery of the position by delivering of the underlying asset.

(3) CASH SETTLEMENT

For some futures contracts settlement is made in cash only. Such futures contract are known as cash settlement contracts.

CLASSIFICATION BY TRADING OBJECTIVES

Hedgers – A Trader seeking to protect himself against risk.

Speculators – A Trader taking risk in order to make profit

Arbitrageur – A trader seeking for riskless profit

FORWAD CONTRACT

A forward contract, just like futures is an agreement between two parties in which one party, the buyer agrees to buy from the other party, the seller, an underlying asset at a future date at a price established at the start of the contract. The buyer in the contract is called the "long" while the seller is called the "short"

FEATURES OF A FORWARD CONTRACT

1. It is usually a private agreement between two parties
2. Just like futures, money does not change hands,it is only a commitment to transact in future.
3. Contracts are usually informal and not standardized.
4. They are extensively used in the foreign exchange market.

MAJOR ADVANTAGES OF FORWARD CONTRACT

1. It is customized and tailor made.
2. Terms of the contract are very flexible
3. It does not require collaterals.

Derivatives could be used in risk management by hedging a position to protect against the risk of an adverse move in an asset. Hedging is the act of taking an offsetting position in a related

security, which helps to mitigate against adverse price movements. Derivative – a security with a price that is dependent upon or derived from….

A derivative is a financial instrument in which the price depends on the underlying asset. A derivative is a contractual agreement between two parties that indicates which party is obligated to buy or sell the underlying security and which party has the right to buy or sell the underlying security.

Example

For example, assume an investor bought 1,000 shares of Tesla Motors Inc. on May 9, 2013 for N65 a share. The investor held onto his investment for over two years and is now afraid that Tesla will be unable to meet its earnings per share (EPS) and revenue expectations.

Tesla's stock price opened at a price of N243.93 on May 15, 2015. The investor wants to lock in at least N165 of profits per share on his investment. To hedge his position against the risk of any adverse price fluctuations the company may have, **the investor buys 10 put option contracts on Tesla with a strike price of N230 and an expiration date on August 7, 2015.**

The put option contracts give the investor the right to sell his shares of Tesla for N230 a share. Since one stock option contract leverages 100 shares of the underlying stock, the investor could sell 1,000 (100 * 10) shares with 10 put options.

Hedge – Making an investment to reduce the risk of adverse price movements

Derivatives Time Bomb – A possible situation where the financial markets ….

Underlying Security - The security on which a derivative derives its value

Exchange Traded Derivative – A financial whose value is based on value of another

Short Hedge – An investment strategy that is focused on mitigating a risk that …

Tesla is expected to report its earnings on August 5, 2015. If Tesla misses its earnings expectations and its stock price falls below N230, the investor could sell 1,000 shares while locking in a profit of N165 (N230 - N65) per share.

Derivatives as a tool of Financial Risk Management

Managing Financial Risk is one of the most essential activities that every firm needs to consider. Financial risk is the type of risk that involves financial loss to a firm. Financial risks can be classified into various types such as Market risk, Credit risk, Liquidity risk and Operational risk.

Market risk is classified into directional and non-directional risk

Credit risk into sovereign risk and settlement risk

Liquidity risk into asset liquidity risk and funding liquidity risk

Operation risk into fraud risk, model risk and legal risk.

After realizing what financial risk is and its types, the next major concern for firms is to perform financial risk management. Various tools were and are used for managing financial risk a**nd out of all derivatives are the most widely used tool to manage financial risk. Let's discuss derivatives as a tool of financial risk management in this post.**

What are Derivatives?

Derivatives as the term suggests are private contracts that derive value from underlying assets such as bonds, currency, indexes and so on. There are different types of derivatives used as tools of financial risk management. Below are the most popularly used ones:

Types of Derivatives:

- Forwards Derivative Contract
- Futures Derivative Contract
- Options Derivative Contract
- Swaps Derivative Contract

Example of Derivatives

A simple example might provide a better understanding. Suppose a trader wants to buy 200 stocks of Microsoft next month. To avoid financial risk, a private contract is signed between the

trader and the seller party. In that contract, an estimated price is fixed at the time of contract and even if the price increases, the trader pays the same amount for the stocks.

Forward Derivative Contract

Now the estimated price depends on future price expectation. If the price is expected to increase in future, the estimated price will be kept higher than the current price. On the other hand, if the price is expected to decrease in future, the estimated price will be decided lower than the current price. Thus, contract price is dependent on current price and future expectation. This type of derivative is termed as forward derivative contract which is widely used across industries to control financial risks.

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Use of Derivatives to Manage Interest Rate Risk.

We use various derivative financial instruments to manage our exposure to fluctuations in interest rates, including interest rate swaps, swaptions, futures, total return swaps, mortgage-backed forwards and options.

We use interest rate swaps, futures contracts and mortgage-backed forwards to **hedge changes** in interest rates subsequent to the issuance of an insurance liability, such as a guaranteed investment contract, but prior to the purchase of a supporting asset, or during periods of holding assets in anticipation of near term liability sales.

We use interest rate swaps primarily to more closely match the interest rate characteristics of assets and liabilities. They can be used to change the sensitivity to the interest rate of specific assets and liabilities as well as an entire portfolio.

We also use these instruments to hedge the interest rate exposure in our commercial mortgage-backed securitization operations. Occasionally, we will sell a callable investment-type agreement and will use written interest rate swaptions to transform the callable liability into a fixed term liability.

The Importance Of Derivatives In Risk Management

Banks, brokers, portfolio managers and even the entire financial industry are exposed to risks on a daily basis. Due to this and especially since the financial crisis, the importance of risk management has increased rapidly.

The fundamentals of risk management are not to completely eliminate risks, but to manage them accordingly.

As financial markets grow, there is an increasing need to manage risks appropriately. The solution lies within the use of financial derivatives.

The importance of derivatives in risk management

Futures, options, swaps and even forward contracts are viewed as the main forms of derivatives. Since development of swaps in the 1980s, the two main swap contracts in the financial sector are currency and interest-rate swaps.

The methodology of interest rate swaps involves an over the counter (OTC) derivative in which there is an agreement between two parties to exchange interest rate cash flows. If a firm wishes to reduce its exposure to interest rate sensitivity, then the best contract would be to pursue an interest rate swap.

With an interest rate swap contract, for example, the payments of a flow rate of interest may be agreed in exchange for a fixed rate of interest. As a result, the value of assets and liabilities are unaffected and thus the position is hedged.

So, the floating rate of interest payments can be exchanged for a fixed rate of interest (and vice versa). Interest rate swaps are essential when it comes to risk management, as the contract can be used to hedge, speculate and manage risks. Any volume of floating and fixed interest rate exposures are cancelled out, with interest rate swaps offsetting any remaining interest rate risk.

The relationship between derivatives and risk management is relatively simple. Derivatives are seen as the tool that enables banks and other financial institutions to break down risks into smaller elements. From this, the elements can be bought or sold to align with the risk management objectives. So, the original purpose of derivatives was to hedge and spread risks. The main motive of the financial tool has aided with the great development and expansion of derivatives. **For instance, in order to overcome interest rate risk, an alternative to total return swaps was created, that is credit default swaps (CDSs).**

CDSs are unique, as they transfer the risk of default from the holder to seller of a fixed income security. If the CDS loan defaults, the seller will have to pay for the loss through a payment that is equal to the value of the original loan minus the secondary market value of the defaulted loan. The increase in trading of CDS has led to a transfer of credit risk from banks to insurance companies. So, credit default swaps are useful for risk management, as it is a tool for

hedging risks. Along with insurance corporations, hedge, mutual and pension funds are the net sellers of credit protection. **However, the financial crisis of 2008 has dampened the reputation of credit default swaps significantly.**

Derivatives have revolutionised the management of risk within the financial world. The tool has allowed unwanted risks to be sold off, with the efficient management of risks that wish to be kept.

Financial derivatives allow specific risks to be targeted and dealt with as well as used for hedging against unwanted risk. The instrument has become so important that a firm is at a greater risk if they do not use derivatives. Market efficiency can be improved, as the financial instrument allows risks to be sold onto those that are willing to accept them, i.e. insurance firms. At the same time, if there is a poor structure of risk management within a financial corporation then derivatives begin to become dangerous for managing risk. If derivatives are not fully understood, then the instrument may start to pose financial threats

What is financial risk & risk management?

In finance, the definition of risk is endless. Risk can be viewed as the chance of a client or government defaulting on its bonds or even the possibility of a financial loss from an investment. Overall, financial risk involves combining both uncertainty and benefits of outcomes.

Risk can be measured through statistical methods such as the standard deviation, beta and correlation coefficient. Another important measure is that of Greeks, which are denoted mathematically by Delta, Gamma, Vega and Theta.

Managing risks is an important feature that has the ability to determine whether a financial firm succeeds or fails. Risk management is based around identifying any threats and risks imposed to a firm or investment and thus dealing with it through the right instruments. Sophisticated models such as value at risk (VaR) are used to calculate, manage and control risks.

Financial derivatives are useful for dealing with various types of risks, mainly market, credit and operational risks. The importance of derivatives has been increasing since the instrument has

been used to hedge against price movements. The financial tool assists with the transfer of risks associated with a specific portfolio without requiring selling the portfolio itself. Essentially, derivatives allow investors to manage their risks and so reach the desired risk profile and allocation more efficiently.

OPTIONS – a thing that is or may be chosen. ”choose the cheapest options for supplying energy”. Synonyms: choice, alternative, recourse, possibility, course of action.

Verb
3rd person present:options buy or sell an option on.”His second script will have been optioned by the time you read this”

An option is a contract that gives the buyer the right, but not the obligation, to buy or sell an underlying asset at a specific price on or before a certain date. An option, just like a stock or bond, is a security. It is also a binding contract with strictly defined terms and properties.

Still confused? The idea behind an option is present in many everyday situations. Say, for example, that you discover a house that you'd love to purchase. Unfortunately, you won't have the cash to buy it for another three months. You talk to the owner and negotiate a deal that gives you an option to buy the house in three months for a price of N200,000. The owner agrees, but for this option, you pay a price of N3,000.

Now, consider two theoretical situations that might arise:

1. It's discovered that the house is actually the true birthplace of Elvis! As a result, the market value of the house skyrockets to N1 million. Because the owner sold you the option, he is obligated to sell you the house for N200,000. In the end, you stand to make a profit of N797,000 (N1 million - N200,000 - N3,000).
2. While touring the house, you discover not only that the walls are chock-full of asbestos, but also that the ghost of Henry VII haunts the master bedroom; furthermore, a family of super-intelligent rats have built a fortress in the basement. Though you originally thought you had found the house of your dreams, you now consider it worthless. On the upside,

because you bought an option, you are under no obligation to go through with the sale. Of course, you still lose the N3,000 price of the option.

This example demonstrates two very important points. **First, when you buy an option, you have a right but not an obligation to do something**. You can always let the expiration date go by, at which point the option becomes worthless. If this happens, you lose 100% of your investment, which is the money you used to pay for the option.

Second, an option is merely a contract that deals with an underlying asset. For this reason, options are called derivatives, which mean an option *derives* its value from something else. In our example, the house is the underlying asset. Most of the time, the underlying asset is a stock or an index.

The two types of options are CALLS AND PUTS:

1. A call gives the holder the right to buy an asset at a certain price within a specific period of time. Calls are similar to having a long position on a stock. Buyers of calls hope that the stock will increase substantially before the option expires.
2. A put gives the holder the right to sell an asset at a certain price within a specific period of time. Puts are very similar to having a short position on a stock. **Buyers of puts hope that the price of the stock will fall before the option expires.**

Participants in the Options Market

There are four types of participants in options markets depending on the position they take:

1. Buyers of calls
2. Sellers of calls
3. Buyers of puts
4. Sellers of puts

People who buy options are called holders and those who sell options are called writers; furthermore, buyers are said to have long positions, and sellers are said to have short positions.

Here is the important distinction between buyers and sellers:

- Call holders and put holders (buyers) are not obligated to buy or sell. They have the choice to exercise their rights if they choose.
- Call writers and put writers (sellers), however, are obligated to buy or sell. This means that a seller may be required to make good on a promise to buy or sell.

Don't worry if this seems confusing - it is. For this reason we are going to look at options from the point of view of the buyer. Selling options is more complicated and can be even riskier. At this point, it is sufficient to understand that there are two sides of an options contract.

The Lingo

TERMINOLGY

To trade options, you'll have to know the terminology associated with the options market.

The price at which an underlying stock can be purchased or sold is called the strike price. This is the price a stock price must go above (for calls) or go below (for puts) before a position can be exercised for a profit. All of this must occur before the expiration date.

An option that is traded on a national options exchange such as the Chicago Board Options Exchange (CBOE) is known as a listed option. These have fixed strike prices and expiration dates. Each listed option represents 100 shares of company stock (known as a contract).

For call options, the option is said to be in-the-money if the share price is above the strike price. A put option is in-the-money when the share price is below the strike price. The amount by which an option is in-the-money is referred to as intrinsic value.

The total cost (the price) of an option is called the premium. This price is determined by factors including the stock price, strike price, time remaining until expiration (time value) and volatility.

Because of all these factors, determining the premium of an option is complicated and beyond the scope of this presentation.

OPTIONS BASICS: WHY USE OPTIONS? There are two main reasons why an investor would use options: to speculate and to hedge.

Speculation

You can think of speculation as betting on the movement of a security. The advantage of options is that you aren't limited to making a profit only when the market goes up. Because of the versatility of options, you can also make money when the market goes down or even sideways.

Speculation is the territory in which the big money is made - and lost. The use of options in this manner is the reason options have the reputation of being risky. This is because when you buy an option, you have to be correct in determining not only the direction of the stock's movement, but also the magnitude and the timing of this movement. To succeed, you must correctly predict whether a stock will go up or down, and you have to be right about how much the price will change as well as the time frame it will take for all this to happen. And don't forget commissions! The combinations of these factors means the odds are stacked against you.

So why do people speculate with options if the odds are so skewed? Aside from versatility, it's all about using leverage. When you are controlling 100 shares with one contract, it doesn't take much of a price movement to generate substantial profits.

Hedging

The other function of options is hedging. Think of this as an insurance policy. Just as you insure your house or car, options can be used to insure your investments against a downturn. Critics of options say that if you are so unsure of your stock pick that you need a hedge, you shouldn't make the investment. On the other hand, there is no doubt that hedging strategies can be useful, especially for large institutions. Even the individual investor can benefit. Imagine that you wanted to take advantage of technology stocks and their upside, but say you also wanted to limit any losses. By using options, you would be able to restrict your downside while enjoying the full upside in a cost-effective way..)

A Word on Stock Options

Although employee stock options aren't available to everyone, this type of option could, in a way, be classified as a third reason for using options. Many companies use stock options as a way to attract and to keep talented employees, especially management. They are similar to regular stock options in that the holder has the right but not the obligation to purchase company stock. The contract, however, is between the holder and the company, whereas a normal option is a contract between two parties that are completely unrelated to the company.

OPTIONS BASICS: TYPES OF OPTION

There are two main types of options:

- American options can be exercised at any time between the date of purchase and the expiration date. The example about Cory's Tequila Co. is an example of the use of an American option. Most exchange-traded options are of this type.
- European options are different from American options in that they can only be exercised at the end of their lives.

The distinction between American and European options has nothing to do with geographic location.

Long-Term Options

So far we've only discussed options in a short-term context. There are also options with holding times of one, two or multiple years, which may be more appealing for long-term investors.

These options are called long-term equity anticipation securities (LEAPS). By providing opportunities to control and manage risk or even to speculate, LEAPS are virtually identical to regular options. LEAPS, however, provide these opportunities for much longer periods of time. Although they are not available on all stocks, LEAPS are available on most widely held issues.

Exotic Options

The simple calls and puts we've discussed are sometimes referred to as plain vanilla options. Even though the subject of options can be difficult to understand at first, these plain vanilla options are as easy as it gets!

What is the difference between trading currency futures and spot FX?

A FOREIGN EXCHANGE SPOT TRANSACTION

It is also known as **FX** spot, is an agreement between two parties to buy one currency against selling another currency at an agreed price for settlement on the spot date. The exchange rate at which the transaction is done is called the spot exchange rate.

The forex market is a very large market with many different features, advantages and pitfalls. Forex investors may engage in currency futures as well as trade in the spot forex market. The difference between these two investment options is very subtle, but worth noting.

- A currency futures contract is a legally binding contract that obligates the two parties involved to trade a particular amount of a currency pair at a predetermined price (the stated exchange rate) at some point in the future.

Assuming that the seller does not prematurely close out the position, he or she can either own the currency at the time the future is written, or may "gamble" that the currency will be cheaper in the spot market some time before the settlement date.

With the spot FX, the underlying currencies are physically exchanged following the settlement date.

Example

In general, any spot market involves the actual exchange of the underlying asset; this is most common in commodities markets. For example, whenever someone goes to a bank to exchange currencies, that person is participating in the forex spot market.

The main difference between currency futures and spot FX is when the trading price is determined and when the physical exchange of the currency pair takes place. With currency futures, the price is determined when the contract is signed and the currency pair is exchanged on the delivery date, which is usually some time in the distant future.

In the spot FX, the price is also determined at the point of trade, but the physical exchange of the currency pair takes place right at the point of trade or within a short period of time thereafter.

However, it is important to note that most participants in the futures markets are speculators who usually close out their positions before the date of settlement and, therefore, most contracts do not tend to last until the date of delivery.

In finance, a foreign exchange swap**, forex** swap**, or** FX swap **is a simultaneous purchase and sale of identical amounts of one** currency **for another with two different value dates (normally spot to forward) and may utilize** foreign exchange **derivatives.**

What is a 'Foreign Currency Swap'

A foreign currency swap is an agreement to make a currency exchange between two foreign parties. **The agreement consists of swapping principal and interest payments on a loan** made in one currency for principal and interest payments of a loan of equal value in another currency. TheFederal Reserve System offered this type of swap to several developing countries in 2008.

A **foreign currency option** is a contract giving the **option** purchaser (the buyer) the right, but not the obligation, to buy or sell a fixed amount of **foreign** exchange at a fixed price per unit for a specified time period. Holder: The buyer of an **option** is called the holder

In finance, a **foreign exchange option** (commonly shortened to just **FX option** or **currency option**) is a derivative financial instrument that gives the right but not the obligation to exchange money denominated in one currency into another currency at a pre-agreed exchange rate on a specified date.

The foreign exchange options market is the deepest, largest and most liquid market for options of any kind. Most trading is over the counter (OTC) and is lightly regulated, but a fraction is traded

on exchanges like the International Securities Exchange, Philadelphia Stock Exchange, or the Chicago Mercantile Exchange for options on futures contracts. The global market for exchange-traded currency options was notionally valued by the Bank for International Settlements at $158.3 trillion in 2005

For example, a GBPUSD contract could give the owner the right to sell £1,000,000 and buy $2,000,000 on December 31. In this case the pre-agreed exchange rate, or strike price, is 2.0000 USD per GBP (or GBP/USD 2.00 as it is typically quoted) and the notional amounts (notionals) are £1,000,000 and $2,000,000.

This type of contract is both a call on dollars and a put on sterling, and is typically called a *GBPUSD put*, as it is a put on the *exchange rate*; although it could equally be called a *USDGBP call*.

If the rate is lower than 2.0000 on December 31 (say 1.9000), meaning that the dollar is stronger and the pound is weaker, then the option is exercised, allowing the owner to sell GBP at 2.0000 and immediately buy it back in the spot market at 1.9000, making a profit of (2.0000 GBPUSD − 1.9000 GBPUSD) × 1,000,000 GBP = 100,000 USD in the process. If instead they take the profit in GBP (by selling the USD on the spot market) this amounts to 100,000 / 1.9000 = 52,632 GBP.

- Call option – the right to buy an asset at a fixed date and price.
- Put option – the right to sell an asset a fixed date and price.
- Foreign exchange option – the right to sell money in one currency and buy money in another currency at a fixed time and relative price.
- Strike price – the asset price at which the investor can exercise an option.
- Spot price – the price of the asset at the time of the trade.
- Forward price – the price of the asset for delivery at a future time.
- Notional – the amount of each currency that the option allows the investor to sell or buy.
- Ratio of notionals – the *strike*, not the current *spot* or *forward*.
- Non-linear payoff – the payoff for a straightforward FX option is linear in the underlying currency, denominating the payout in a given numéraire.
- Numéraire – the currency in which an asset is valued.
- Change of numéraire – the implied volatility of an FX option depends on the numéraire of the purchaser, again because of the non-linearity of .

In the money: for a call position is when SP<MP and for put position is when SP>MP

The difference between FX options and traditional options is that in the latter case the trade is to give an amount of money and receive the right to buy or sell a commodity, stock or other non-money asset. In FX options, the asset in question is also money, denominated in another currency.

For example, a call option on oil allows the investor to buy oil at a given price and date. The investor on the other side of the trade is in effect selling a put option on the currency.

To eliminate residual risk, match the *foreign* currency notionals, not the local currency notionals, else the foreign currencies received and delivered don't offset.

In the case of an FX option on a *rate*, as in the above example, an option on GBPUSD gives a USD value that is linear in GBPUSD using USD as the numéraire (a move from 2.0000 to 1.9000 yields a .10 * $2,000,000 / $2.0000 = $100,000 profit), but has a non-linear GBP value. Conversely, the GBP value is linear in the USDGBP rate, while the USD value is non-linear.

Hedging

Corporations primarily use FX options to hedge *uncertain* future cash flows in a foreign currency. The general rule is to hedge *certain* foreign currency cash flows with *forwards*, and *uncertain* foreign cash flows with *options*.

Suppose a United Kingdom manufacturing firm expects to be paid US$100,000 for a piece of engineering equipment to be delivered in 90 days. If the GBP strengthens against the US$ over the next 90 days the UK firm loses money, as it will receive less GBP after converting the US$100,000 into GBP. However, if the GBP weakens against the US$, then the UK firm receives more GBP. This uncertainty exposes the firm to FX risk. Assuming that the cash flow is certain, the firm can enter into a forward contract to deliver the US$100,000 in 90 days time, in exchange for GBP at the current forward rate. This forward contract is free, and, presuming the expected cash arrives, exactly matches the firm's exposure, perfectly hedging their FX risk.

If the cash flow is uncertain, a forward FX contract exposes the firm to FX risk in the *opposite* direction, in the case that the expected USD cash is *not* received, typically making an option a better choice.

Using options, the UK firm can purchase a GBP call/USD put option (the right to sell part or all of their expected income for pounds sterling at a predetermined rate), which:

- protects the GBP value that the firm expects in 90 days' time (presuming the cash is received)
- costs at most the option premium (unlike a forward, which can have unlimited losses)
- yields a profit if the expected cash is not received but FX rates move in its favor

Valuation: the Garman–Kohlhagen model [edit]

As in the Black–Scholes model for stock options and the Black model for certain interest rate options, the value of a European option on an FX rate is typically calculated by assuming that the rate follows a log-normal process.

In 1983 Garman and Kohlhagen extended the Black–Scholes model to cope with the presence of two interest rates (one for each currency). Suppose that is therisk-free interest rate to expiry of the domestic currency and is the foreign currency risk-free interest rate (where domestic currency is the currency in which we obtain the value of the option; the formula also requires that FX rates – both strike and current spot be quoted in terms of "units of domestic currency per unit of foreign currency"). The results are also in the same units and to be meaningful need to be converted[2] into one of the currencies.

Then the domestic currency value of a call option into the foreign currency is

MODULE TWO

An **interest rate swap** (IRS) is a liquid financial derivative instrument in which two parties agree to exchange **interest rate** cash flows, based on a specified notional amount from a fixed **rate** to a floating **rate** (or vice versa) or from one floating **rate** to another.

A **swaption** is an option granting its owner the right but not the obligation to enter into an underlying swap. Although options can be traded on a variety of swaps, the term "swaption" typically refers to options on interest rate swaps.

Types of swaptions

There are two types of swaption contracts:

- A **payer swaption** gives the owner of the swaption the right to enter into a swap where they pay the fixed leg and receive the floating leg.
- A **receiver swaption** gives the owner of the swaption the right to enter into a swap in which they will receive the fixed leg, and pay the floating leg.

In addition, a "straddle" refers to a combination of a receiver and a payer option on the same underlying swap.

The buyer and seller of the swaption agree on:

- The premium (price) of the swaption
- Length of the option period (which usually ends two business days prior to the start date of the underlying swap),
- The terms of the underlying swap, including:
  - Notional amount (with amortization amounts, if any)
  - The fixed rate (which equals the strike of the swaption)
  - The frequency of observation for the floating leg of the swap (for example, 3 month Libor paid quarterly)

The swaption market

The participants in the swaption market are predominantly large corporations, banks, financial institutions and hedge funds. End users such as corporations and banks typically use swaptions to manage interest rate risk arising from their core business or from their financing arrangements. For example, a corporation wanting protection from rising interest rates might buy a payer swaption. A bank that holds a mortgage portfolio might buy a receiver swaption to protect against lower interest rates that might lead to early prepayment of the mortgages.

A hedge fund believing that interest rates will not rise by more than a certain amount might sell a payer swaption, aiming to make money by collecting the premium. Major investment and commercial banks such as JP Morgan Chase, Bank of America Securities and Citigroup make markets in swaptions in the major currencies, and these banks trade amongst themselves in the swaption interbank market.

The market making banks typically manage large portfolios of swaptions that they have written with various counterparties. A significant investment in technology and human capital is required to properly monitor the resulting exposure. Swaption markets exist in most of the major currencies in the world, the largest markets being in U.S. dollars, euro, sterling and Japanese yen.

The swaption market is over-the-counter (OTC), i.e., not traded on any exchange. Legally, a swaption is a contract granting a party the right to enter an agreement with another counterparty to exchange the required payments. The counterparties are exposed to each other's failure to make scheduled payments on the underlying swap, although this exposure is typically mitigated through the use of collateral agreements whereby variation margin is posted to cover the anticipated future exposure

Swaption styles

There are three main categories of Swaption, although exotic desks may be willing to create customised types, analogous to exotic options, in some cases. The standard varieties are

- Bermudan swaption, in which the owner is allowed to enter the swap on multiple specified dates.
- European swaption, in which the owner is allowed to enter the swap only on the expiration date. These are the standard in the marketplace.[1]
- American swaption, in which the owner is allowed to enter the swap on any day that falls within a range of two dates.

Zero-Coupon Bond

WHAT IT IS:

A **zero-coupon bond** is a bond that makes no periodic interest payments and is sold at a deep discount from face value. The buyer of the bond receives a return by the gradual appreciation of the security, which is redeemed at face value on a specified maturity date.

HOW IT WORKS (EXAMPLE):

The price of a zero-coupon bond can be calculated by using the following formula:

$$\mathbf{P = M / (1+r)^n}$$

where:
P = price
M = maturity value
r = investor's required annual yield / 2
n = number of years until maturity x 2

For example, if you want to purchase a Company XYZ zero-coupon bond that has a $1,000 face value and matures in three years, and you would like to earn 10% per year on the investment, using the formula above you might be willing to pay:

$$\mathbf{\$1,000 / (1+.05)^6 = \$746.22}$$

When the bond matures, you would get $1,000. You would receive "interest" via the gradualappreciation of the security.

The greater the length until a zero-coupon bond's maturity, the less the investor generally pays for it. So if the $1,000 Company XYZ bond matured in 20 years instead of 3, you might only pay:

$$\mathbf{\$1,000 / (1+.05)^{40} = \$142.05}$$

Zero-coupon bonds are very common, and most trade on the major exchanges. Corporations, state and local governments, and even the U.S. Treasury issue zero-coupon bonds. Corporate zero-coupon bonds tend to be riskier than similar coupon-paying bonds because if the issuer defaults on a zero-coupon bond, the investor has not even received coupon payments -- there is more to lose.

For tax purposes, the IRS maintains that the holder of a zero-coupon bond owes income tax on the ir that has accrued each year, even though the bondholder does not actually receive the cash until maturity. The IRS calls this imputed interest.

WHY IT MATTERS:

Zero-coupon bonds are usually long-term investments; they often mature in ten or more years. Although the lack of current income provided by zero-coupons bond discourages some investors, others find the securities ideal for meeting long-range financial goals like college tuition. The deep discount helps the investor grow a small amount of money into a sizeable sum over several years.

Because zero-coupon bonds essentially lock the investor into a guaranteed reinvestment rate, purchasing zero-coupon bonds can be most advantageous when interest rates are high. They are also more advantageous when placed in retirement accounts where they remain tax-sheltered. Some investors also avoid paying taxes on imputed interest by buying municipal zero-coupon bonds, which are usually tax-exempt if the investor lives in the state where the bond was issued.

The lack of coupon payments on zero-coupon bonds means their worth is based solely on their current price compared to their face value. Thus, prices tend to rise faster than the prices of traditional bonds when interest rates are falling, and vice versa. The locked-in reinvestment rate also makes them more attractive when interest rates fall.

WHAT IS A 'FORWARD FORWARD'

A forward forward is an agreement between two parties to engage in a loan transaction in the future. The lender agrees to lend the borrower funds on a specified future date. The borrower agrees to repay the loan, plus a premium, at a date beyond the loan issue date.

BREAKING DOWN 'Forward Forward'

For example: On January 1st, Company A agrees to loan Mr. X $10,000 on June 1st. Mr. X agrees to repay Company A the original $10,000 plus an additional $1000 on December 1st. The $1000 is similar to paying interest on the loan.

Interest rate risk is the **risk** that arises for bond owners from fluctuating **interest rates**. How much **interest rate risk** a bond has depends on how sensitive its price is to **interest rate** changes in the market. The sensitivity depends on two things, the bond's time to maturity, and the coupon **rate** of the bond.

Interest rate risk is the chance that an unexpected change in interest rates will negatively affect the value of an investment.

HOW IT WORKS (EXAMPLE):

Let's assume you purchase a bond from Company XYZ. Because bond prices typically fall when interest rates rise, an unexpected increase in interest rates means that your investment could suddenly lose value. If you expect to sell the bond before it matures, this could mean you end up selling the bond for less than you paid for it (a capital loss). Of course, the magnitude of change in the bond price is also affected by the maturity, coupon rate, its ability to be called, and other characteristics of the bond.

One common way to measure a bond's interest rate risk is to calculate its duration.

WHY IT MATTERS:

In general, short-term bonds carry less *interest rate risk*; less responsive to unexpected interest rate changes than long-term bonds are. This implies that short-term bonds carry less interest rate risk than long-term bonds, and some financial theorists cite this as support for a popular hypothesis that the higher yields of long-term bonds include a premium for interest rate risk.

It is interesting to note that bond investors who intend to hold their bonds to maturity are less exposed to interest rate risk for two reasons. First, these investors are not interested in interim price movements because they intend to hold the bond until it matures. Second, the amount of principal the investor receives at maturity is unaffected by changes in interest rates. However, the buy-and-hold bond investor is still exposed to the risk that interest rates will rise above the

bond's coupon rate, therefore leaving the investor "stuck" with below-market coupon payments.

Interest rate risk accounts for approximately 90% of the risk involved with fixed income investing, according to research by BARRA International. Although analysts and investors spend countless hours analyzing interest rate trends and making forecasts, there is no way to tell for sure what rates will be tomorrow.

DEFINITION of 'Interest Rate Gap'

The difference between fixed rate liabilities and fixed rate assets. Interest rate gap is a measurement of exposure to interest rate risk. The interest rate gap is used to show the risk of exposure and is used by financial institutions and investors to develop hedge positions, often through the use ofinterest rate futures. Calculations are dependent on the maturity date of the securities used in calculations, and the time period remaining before the securities reach maturity.

Interest rate gaps can also apply to the interest rates on the government securities of two different countries.

BREAKING DOWN 'Interest Rate Gap'

Unlike the liquidity gap, which takes into account all assets and liabilities, the interest rate gap only focuses on assets and liabilities which have a fixed rate. For example, a bank may borrow $100 million for 30 days at 5% interest, while at the same time loaning out $100 million for 60 days at 5.5%. An interest rate gap calculation would allow the bank to determine its 30v60 day forward rate.

A measure of exposure or sensitivity to interest rates. Static gap is calculated as the difference between assets and liabilities of comparable repricing periods. Static gap can be calculated for short-term and long-term periods. Minus signs in the calculated gap indicate that you have a greater number of liabilities than assets maturing at that particular maturity, and therefore have

an exposure to rising rates. Static gap is usually calculated for periods of less than a year – often 0 to 30 days or 31 to 90 days – but can also be calculated for multiple periods. Simple static gaps are inherently imprecise measurements because they do not take into account such factors as interim cash flow, average maturity and prepayment of the loan.

DEFINITION of 'Gapping'

In general, a trading strategy in which the participant borrows short and lends long. This strategy gives the lender an overall better interest rate as short rates are generally lower than long rates. Also in technical analysis, gapping can refer to the use of a gap strategy which looks at stocks that display price gaps from previous closes.

BREAKING DOWN 'Gapping'

To employ a gap strategy an investor can scan the morning prices for a gap and watch to see what the stock does in the first couple hours of the trading day. In general, if the price goes up, it signals a buy, and if it goes down, a short. There are several variations of the gap strategy.

DEFINITION of 'Liquidity Gap'

The difference between a firm's assets and a firm's liabilities, caused by said assets and liabilitiesnot sharing the same properties. This gap can be positive or negative, depending on if the firm has more assets than liabilities or vice versa.

BREAKING DOWN 'Liquidity Gap'

For banks, the liquidity gap can change over the course of the day as deposits and withdrawals are made. This means that the liquidity gap is more of a quick snapshot of a firm's risk, rather than a figure that can be worked over for a long period of time. To compare periods of time banks, calculate the marginal gap, which is the difference between gaps of different periods.

DEFINITION of 'Dynamic Gap'

Refers to asset and liability risk management at financial institutions. An asset-liability model that takes into account projected future balances or the difference between interest sensitive assets and interest sensitive liabilities at specific future time periods. Simply: a bank's gap is defined as the difference between a bank's rate-sensitive assets and rate-sensitive liabilities.

1.

BREAKING DOWN 'Dynamic Gap'

Gap analysis is the method to determine the market risk, or interest rate exposure. Dynamic gap analysis attempts to reflect the reality that, on an ongoing basis, loan payments and maturities are replaced with new loans; deposit withdrawals are replaced by new deposits. It is the opposite of static gap analysis.

Interest Rate Risk Gap Analysis

It's common today to discount the importance of that old dependable asset liability standby, the gap report. Yet, the gap report still provides an important window on interest rate risk. Let's review basic gap analysis, and then look at two banks and their gap results.

Gap is the difference between the amount of assets and liabilities on which interest rates are reset during any particular bucket of time. If a bank has both $5 million in assets and $5 million in liabilities that reprice in any given time window, changes in interest rates should not change the bank's net interest margin. This is known as a balanced gap position.

If instead, $10 million in assets reprice with only $5 million in liabilities repricing, the bank is in an asset sensitive position. An asset sensitive bank will enjoy a net interest margin increase if

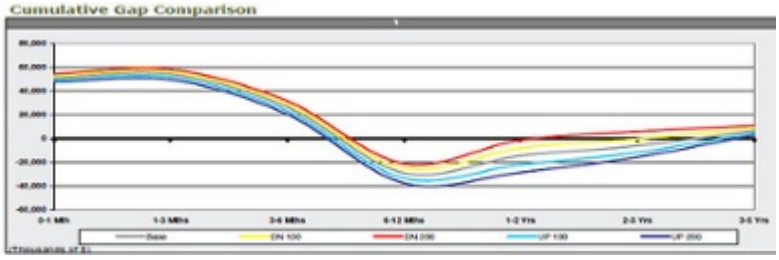
interest rates increase. Of course, as we've seen over the past few years, the asset sensitive bank will have net interest margin compression if rates fall.

The converse situation, with $5 million in assets repricing during the same period that $10 million in liabilities reprice is known as a liability sensitive position. Here, if interest rates increase net interest margin will decline. Similarly, if interest rates fall the liability sensitive bank will anticipate a wider net interest margin.

One of the key criticisms of gap analysis is that it fails to account for optionality in assets and liabilities. That is, if rates fall and your assets prepay faster, or if rates rise and the average life of your assets extend, this information is typically not given by a simple static gap report. Another criticism concerns repricing assumptions on non-maturity deposits. This is a critical assumption and a recent blog post shows our perspective.

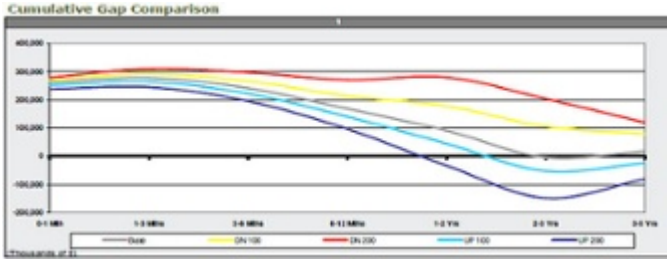
In order to deal with these criticisms, when we create a gap analysis we don't stop with the static information from the ledger. Instead, we examine each line item and every time bucket of assets and liabilities for potential prepayment activity. Some line items such as U.S. Treasury securities, are typically non-prepayable bullets and no adjustment is needed. Loans however, typically amortize, as well as prepay at different speeds for different interest rate environments. By adjusting our base case gap analysis for these, and other, likely behavior traits, we begin the process of converting static accounting data into a dynamic asset liability format. We further extend the analysis by examining the change in the bucketed cash flows for each of the rate shock environments.

So now that we have literally pages of detailed cash flow information, how do we evaluate it? It's here that a picture truly is worth 1000 words. Let's take a look at two examples. The chart shows cumulative gap for each of the time buckets and how it changes in each interest rate shock scenario.



The first bank shows a cumulative gap that is a negative at the one year point, indicating a slight liability sensitive position. Note however that all of the lines representing the various interest rate scenarios are tightly bound. This indicates that regardless of the movement in interest rates the bank's gap position is not expected to change significantly.

Now let's look at the second bank. Here, the cumulative gap position is positive, indicating asset sensitivity, in the one year bucket. Note however the significantly wider variability in gap given changes in interest rates. The



message is clear. As rates change this bank's gap position, especially in the one to three ye.ar bucket, will vary substantially. If you were to look at the underlying cash flow detail, he would find this bank holds significant volumes of fixed rate securities and loans that reprice in the one to three year window. By examining the area of widest variability in gap, you have a head start on identifying the time periods with the most inherent interest rate risk.

In fact, if we were to look at the other measurements of interest rate risk for the same banks we would find that earnings at risk, and economic value of equity show behavior consistent with gap. That is, the first bank shows a very flat to neutral earnings at risk, and economic value of equity, with a slight bias toward long term liability sensitivity. The second bank, with wider variability in gap results, also shows substantially higher variability in both earnings at risk and EVE.

For most community banks, without a concentration of complex instruments on the balance sheet, the three basic measurements of interest rate risk should generally show consistent results. Don't shy away from using gap to identify where your interest rate risk lies simply because it's an older, time-tested tool. **As long as you understand the limitations of gap, it remains a highly effective measure of interest rate risk.**