Chapter 14
SECONDARY MARKETS:
Derivative Investments:
Futures, Forwards, Swaps, Swaptions, CDA's, FRA's and Other Derivatives

This chapter will give an overview of the futures exchange markets, cover forward contracts and describe other derivatives such as Swaps, Swaptions, Credit Default Swaps and Forward Rate Agreements. It will describe various strategies used by investors for hedging against interest rate and market price movements as well as foreign currency and commodity increases or decreases.

Learning Objectives

After reading this chapter, students will be able to**:**

- Understand how the future exchange market works and how these types of investments are traded and managed as part of an overall investment strategy.
- Understand the various hedging strategies against interest rate, foreign currency rate and commodity price movements
- Learn about other types of derivatives such as Swaptions, Credit Default Swaps and Forward Rate Contracts.

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AUTHOR'S NOTES:
It would be great if we could read tomorrow's newspaper, see which stocks would do well, buy today and guarantee ourselves a healthy gain. It would be great to know tomorrow's lottery drawing's or next week's main news so we could position ourselves today to take advantage of future events. The problem is, of course that we can't predict the future, and what happens in the future is impossible to know for certain. We know that everyone will die at some point, but we don't know when. We pay for life insurance just in case. Life insurance is basically a futures contract where the two parties, the insurance company and the policy holder, place a side bet; if the policy holder dies the insurance will pay the policy holder's beneficiaries $1 million dollars, however for every month the policy holder "loses" the bet, they will pay $150 per month in premiums. In addition, every month after the $150 is made the bet is reset for next month. I was always fascinated how insurance companies could price someone's life at $150 per month for a $1 million payoff. The actuarial science behind premium pricing is based on the probability of life expectancy given someone's age and health condition. The core analysis of investments, finance

and credit (the title of this text book) is to quantify future return given an investment's risk expectation.

The #1 New York Times bestselling book "The Big Short" written by Michael Lewis, which later became a successful Hollywood movie, describes a few investors that waited very patiently to benefit from the collapse of the mortgage markets. The book writes about a hedge fund manager named Michael Burry that visited many of the major investment banks asking them to structure an instrument that would allow him to benefit from the potential collapse of the housing market. These banks were happy to create such a vehicle, using a structure called a Credit Default Swap (CDS) that would allow Michael Burry to short the housing market. There is a scene in the movie where representatives from the various investment banks are laughing and mocking the stupidity of such an idea. The CDS was structured like a life insurance policy. The investors in the CDS would be paying monthly premiums and the payoff ("death benefit") would be based on the event of default of Collateralized Debt Obligations (CDOs) that included mortgage-backed securities, secured by subprime mortgages, and funded by various tranches of debt that are rated by the rating agencies. These fund's structures start at the top with the highest quality tranches including AAA securities, to then AA and all the way down to the risky BB security tranches. One of my favorite scenes is when the actor Ryan Gosling, playing an investment banker, pulls blocks from a Jenga tower showing how the debt tranches work in mortgage-back securities. He explains, how by pulling the blocks from the lower part of the tower, the top-rated securities at the top would fall too.

Profiting, hedging or exiting your investment today based on future events such as the movement of interest and currency rates or the price of coffee have become the main analytical objective of every analyst on wall street. This, with the goal of securing or strengthening their investment in case of certain expected price movements.

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KEY TAKEAWAYS:

- *The difference between options and futures is that option investors have the <u>right or option</u> to buy or sell securities in the future whereas futures' investors have the <u>obligation</u> to buy or sell securities in the future.*
- *Many future and forward strategies are designed to either protect or hedge the underlying investments or enhance the overall exposure to a future event for maximum profit.*
- *An investor that trades futures gains a better understanding of how interest or currency rates move and what the investor is pricing into the bonds based on default expectation in the future.*

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Forwards, Futures Swap Contracts- Overview

The main difference between option contracts, described in the previous chapter, and other derivatives such as forwards and futures contracts is that the buyer of an option pays upfront to obtain the right to exercise the option in the future and buy or sell the underlying stock. In the case of forward and future contracts, the parties are both obliged to sell or buy from each other on a specific date for a specific price. Swaps are also different than options as they are contracts in which the parties agree to exchange cash flows based on a set interest and currency rate today. Forwards, futures and swaps are types of securities that are derived by the direction of other securities such as interest rates, currency rates, commodity prices or index levels. When comparing contracts between options and futures, it is important to note that they have the same input characteristics including a future price (letters "X" in options and "K" in futures), an underlying asset such as a stock or commodity (both represent letter "S" for "Stock" and "Spot" for options and futures, respectively), and an expiration date (delivery day for forwards). The difference is the obligation that comes with future contracts, as well as the fact that options contracts carry a premium (p) while futures and forwards do not.

1. Forward Contracts

A forward contract is a private and highly customized contract between two parties to buy or sell a specific asset at a pre-agreed upon price on a specific future date. Typically, these contracts are between large institutions – basically the public does not get involved in these forward transactions. However, they can access these types of opportunities in the futures market as discussed in the next section. The terms and conditions of a forward contract will include the description of the asset such as the specific commodity, the price of the asset, the delivery date and the volume to be traded. Forwards are used primarily for hedging purposes. Typical forward contracts are usually on commodities that could include precious metals, agricultural products, natural gas and oil. A forward contract settlement can occur on a cash or delivery basis. The cash basis is receiving or paying the difference between the future price and the spot price. The Delivery basis is basically paying for receiving the delivery of the actual asset and receiving payment if you deliver the asset to the buyer.

Consider a perfect real example that both parties can benefit from a delivery basis forward contract. Assume a farmer that produces wheat sells his stock primarily to a local bread company. This farmer's cash flow is primarily dependent on wheat prices. The farmer knows the market prices for wheat will tend to fluctuate from the time the farmer harvests the wheat until it is delivered it to the bread company. The farmer, wanting to secure his revenues, looks for a way to ensure the amount he'll receive for his inventory. This could be especially important for the farmer if he has debt payments such as a mortgage on his farm or leases on his equipment. Securing his revenue is essential if he wishes to predict what he can pay towards his loans and still profit in order to stay in business. In this case, the farmer will seek to enter into a contract with the bread company to lock in the delivery price, volume, and date for his sale. Along the same lines, the bread company oddly enough is faced with the same problem as the farmer. The bread company needs to lock in it's expenses in order to accurately predict its profit. For the bread company, wheat cost represents the highest and potentially variable cost component in their income statement. The forward contract between the wheat farmer and the bread company will include the volume, price, date, volume, and will be delivered as follows:

Buyer: Bread Company
Seller: Wheat Farms Inc.
Volume: 1 million bushels
Price: $4.45
Delivery Date: 03/15/20xx (6 months from today)

Two different views: The seller is concerned about a potential decline in the price of wheat and the buyer is concerned that the wheat's prices will increase by the time one million bushels of wheat is delivered. With the contract in place, no matter what happens to wheat prices the seller is promised to be paid $4.45 per bushel or $4.45 million and the buyer is obliged to pay $4.45 per bushel or $4.45 million on delivery date as the 1 million bushels are satisfied.

This contract can also be done with a financial institution on a cash basis to hedge the farmer's position as a derivative to wheat's current spot price. In this case, the farmer signs a "Short" price contract because he is hedging against a decline in wheat prices. The bread company can also reach out to a financial institution to hedge their cost via a derivative forward contract. In this case, the bread company signs a "Long" contract since it is hedging against any increase in price. Both contracts (direct) between the farmer and the bread company and indirect derivative contract between the parties, separately, as well as the financial institutions are illustrated in figure 14.1 below.

Insert Figure 14.1

FORWARD CONTRACTS

Direct Contracts and Indirect Derivative Contracts

DIRECT PRIVATE FORWARD CONTRACT BETWEEN TWO PARTIES (Not using the financial institution)

BUYER:	Bread Company	
SELLER:	Wheat Farms Inc.	
VOLUME:	1,000,000	bushels
PRICE:	$ 4.45	per bushel
TOTAL COST	$ 4,450,000	
DATE:	3/15/20XX	(6 months)
TYPE:	Delivery Basis	

Bread Company

Income Statement	3/15/20XX
Revenues	
Cost of Goods Sold - Wheat Expenses	(4,450,000)

Wheat Farms Inc.

Income Statement	3/15/20XX
Revenues	4,450,000
Cost of Goods Sold - Wheat Expenses	

INDIRECT (DERIVATIVE)FORWARD CONTRACT BETWEEN EACH PARTY (LONG & SHORT) WITH FINANCIAL INSTITUTION

PARTY A		
LONG:	Bread Company	
CONTRACT:	42,000	bushels
VOLUME:	1,000,000	bushels
NO OF CONTRACTS:	24.00	aproxim.
PRICE:	$ 4.45	
EXP. DATE:	3/15/20XX	(6 months)
TYPE:	Cash Basis	

PARTY B		
SHORT:	Wheat Farms Inc.	
CONTRACT:	42,000	bushels
VOLUME:	1,000,000	bushels
NO OF CONTRACTS:	24.00	aproxim.
PRICE:	$ 4.45	
EXP. DATE:	3/15/20XX	(6 months)
TYPE:	Cash Basis	

Bread Company

Transaction on Delivery/Expiration Day	WHEAT PRICES ON DELIVERY DAY		
Increase/Decrease in Spot Prices	-$ 0.50	$ 0.00	$ 0.50
Scenarios - Spot Prices	$ 3.95	$ 4.45	$ 4.95
Cost of Wheat Purchases at Spot Prices	(3,950,000)	(4,450,000)	(4,950,000)
+ Profit/Loss form Forward Contract	(500,000)	-	500,000
Net Payment	(4,450,000)	(4,450,000)	(4,450,000)

Fully Hedged

Wheat Farms Inc.

Transaction on Delivery/Expiration Day	WHEAT PRICES ON DELIVERY DAY		
Increase/Decrease in Spot Prices	-$ 0.50	$ 0.00	$ 0.50
Scenarios - Spot Prices	$ 3.95	$ 4.45	$ 4.95
Revenue from Wheat Sales at Spot Price	3,950,000	4,450,000	4,950,000
+ Profit/Loss form Forward Contract	500,000	-	(500,000)
Total Proceeds	4,450,000	4,450,000	4,450,000

Fully Hedged

Figure 14.1

For the derivative contract between the parties and the financial institutions, the parties will pay or receive the contract depending on the spot price upon expiration day. Figure 14.1 above shows three possibilities of the wheat spot price at expiration day:

If it's exactly $4.45 per bushel (contract price), no money is owed by the farmer or the bread company to the financial institution and the contract is closed. If the spot price is lower than the contract price ($3.95), the bread company will pay the lower price to buy the wheat in their course of doing their business, but also pay the cash difference between the contract price and the spot price ($0.50 x 1 million bushels). The wheat company will receive lower revenues by their customers for selling wheat at $3.95 per bushel, or $3,950,000. However, they will make up the difference from the lower price by also receiving $500,000 from the derivative contract ($0.50 x 1 million bushels). At a higher spot price, the bread company will pay its suppliers $4,950,000, or 4.95 a bushel, but will receive $500,000 from the derivative contract to offset the higher prices. The farmer will receive higher revenues for selling their wheat at a higher spot price, but will be asked to pay for their derivative contract resulting to net proceeds of $4,450,000.

Risks with Forward Contracts

The market for forward contracts is huge since many of the world's biggest corporations use it to hedge currency and interest rate risks. However, since the details of forward contracts are restricted to the buyer and seller – and are not known to the general public – the size of this market is difficult to estimate.

The large size and unregulated nature of the forward contracts market makes it susceptible to a cascading series of defaults in the worst-case scenarios. While banks and financial corporations mitigate this risk by being very careful in their choice of counterparty, the possibility of large-scale default does exist.

2. Future Contracts – Commodities

Futures contracts have the exact same characteristics as forward contracts with the exception being that futures trade in the exchange markets that the public can invest in. Most transactions are on a cash basis but there is an option, rarely used, to receive the actual delivery of the asset. Figure 14.2 shows the future trading prices (Expiring 1 or 2 months from today):

Insert Figure 14.2

FUTURES MARKETS - EXCHANGE PRICE

April 2019

AGRICULTURE

	Volume per Contract	Units	Future Price	$ Change	% Change	Delivery Day (Future)
Cocoa (ICE)	10	USD/MT	2,342.00	(30.00)	-1.26%	May 19
Coffee 'C' (ICE)	37,500	USd/lb.	92.85	(0.05)	-0.05%	May 19
Corn (CBOT)	5,000	USd/bu.	364.50	(2.75)	-0.75%	May 19
Cotton #2 (ICE)	50,000	USd/lb.	78.37	0.10	0.13%	May 19
Lean Hogs (CME)	40,000	USd/lb.	94.23	(2.52)	-2.61%	May 19
Live Cattle (CME)	40,000	USd/lb.	121.50	(1.17)	-0.96%	May 19
Oats (CBOT)	5,000	USd/bu.	279.50	1.25	0.45%	May 19
Orange Juice (ICE)	15,000	USd/lb.	109.80	(0.35)	-0.32%	May 19
Rough Rice (CBOT)	2,000	USD/cwt	10.69	0.02	0.14%	May 19
Soybean (CBOT)	60,000	USd/bu.	891.75	(2.50)	-0.28%	May 19
Sugar #11 (ICE)	112,000	USd/lb.	12.77	(0.21)	-1.62%	May 19
Wheat (CBOT)	5,000	USd/bu.	441.25	(7.00)	-1.56%	May 19

Precious Metals & Industrial Metals

	Volume per Contract	Units	Price	$ Change	% Change	Delivery Day (Future)
Aluminum (LME)	25	USD/MT	6,476.00	(80.00)	-1.22%	May 19
Copper (Comex)	25,000	USD/lb	291.10	(1.55)	-0.53%	May 19
Gold (Comex)	100	USD/t oz.	1,277.50	1.50	0.12%	May 19
Silver (Comex)	5,000	USD/t oz.	15.06	0.02	0.11%	May 19

Energy

	Volume per Contract	Units	Price	$ Change	% Change	Delivery Day
Brent Crude (ICE)	1,000	USD/bbl.	74.20	2.23	3.10%	May 19
Heating Oil (Nymex)	42,000	USd/gal.	211.35	4.26	2.06%	May 19
Natural Gas (Nymex)	10,000	USD/MMBtu	2.52	0.03	1.24%	May 19
WTI Crude Oil (Nymex)	1,000	USD/bbl.	65.75	1.75	2.73%	May 19

Interest Rate Funds

	Volume per Contract	Units	Price	$ Change	% Change	Delivery Day
Treasury Bonds (CBT)	100,000	pts 32nds of100%.	145-080	15.00	0.10%	Jun 19
Treasury Notes (CBT)	100,000	pts 32nds of100%.	122-050	12.50	0.25%	Jun 19
5-yr Tresury Notes (CBT)	100,000	pts 32nds of100%.	114-195	6.50	1.24%	Jun 19
30-Day Fed Funds (CBT)	5,000,000	Daily Avg	97.60	-	0.00%	May 19
1-Month Libor (CME)	3,000,000	pts of 100%	97.49	0.01	0.00%	May 19

Currency Futures

	Volume per Contract	Units	Price	$ Change	% Change	Delivery Day
Japanese Yen (CME)	¥12500000	$ per 100 ¥	97.2900	-	0.00%	Jun 19
Canadian Dollar (CME)	100,000	$ per CAD	0.7351	0.001	0.14%	Jun 19
Euro (CME)	€125,000	$ per €	1.1523	0.011	0.95%	Jun 19

Index Futures

	Volume per Contract	Units	Price	$ Change	% Change	Delivery Day
S&P 500 Index (CME)	250	$USD x Index	2,505.20	19.20	0.77%	Jun 19
Mini Nasdaq 100 (CME)	20	$USD x index	6,333.30	40.00	0.63%	Jun 19
Mini Russel 2000 (CME)	50	$USD x index	1,349.00	8.10	0.60%	Jun 19

Figure 14.3

Typically, the future markets are divided into 5 major commodity sections: Agriculture, Precious Metals & Industrial Metals, Energy, Currency Futures and Index Futures. Each asset also has a customized amount of units per contract. For example, Figure 14.2 above shows that Silver's one contract is 5,000 troy ounces, so buying the Silver futures at $15.06 per troy ounce will cost $75,300. The brokers will ask the investor to deposit 10% of that amount or $7,530 (initial margin) and at expiration day, the settlement will be set up on cash basis and expected to be paid or receive the difference between the original future price and current price which should converged to the spot price on delivery day. A delivery basis contract gives the investor the right to buy 5,000 ounces at $15.06, no matter what happens to the price.

There are two following reasons for the investor to enter into a futures contract:

1. **Speculation:** This is when investors enter into futures contracts if they believe the underlying asset such as a commodity price, interest rate, or market index will increase or decrease based on specific events. If the investor anticipates an increase in the price of an underlying asset in the future, they could potentially profit by purchasing the asset at a set price via entering a futures contract and selling it later at a higher price in the spot market through cash settlement. However, if the underlying asset declines, they could lose the difference between the future price they locked-in and the spot price.

2. **Hedging:** The purpose of hedging, like the example used in the forward contract, is not to profit from any favorable price movements but to prevent losses from selling or buying the underlying asset as a course of business – see example of the farmer and wheat companies shown in Figure 14.1 above.

For an investor to set-up a futures contract account, most brokers will ask the investors to deposit 10%-15% of the potential delivery amount (future price x volume) times the number of contracts. The prices are settled every day and a mark-to-market tracks the account to see if the investor needs to deposit additional funds to cover the original margin (10-15%). Figure 14.3 below shows an example of the original deposit and the mark-to-market daily settlement until expiration.

Insert Figure 14.3

FUTURES and FORWARDS

Silver (COMEX) 5,000 USD/troy oz. April 20xx

Precious Metals & Industrial Metals	Volume per Contract	Units	Price	$ Change	% Change	Delivery Day (Future)
Aluminum (LME)	25	USD/MT	6,476.00	(80.00)	-1.22%	May XX
Copper (Comex)	25,000	USD/lb	291.10	(1.55)	-0.53%	May XX
Gold (Comex)	100	USD/t oz.	1,277.50	1.50	0.12%	May XX
Silver (Comex)	5,000	USD/t oz.	15.06	0.02	0.11%	May XX

Daily Mark-to-Market - 5/15/20xx

Day			Futures Price	Profit (loss) per ounce	USD / Unit Contract contract		Deposit (Initial Invest.)	10% Balance *	Balance	Profit	HPR%
5/10/20xx	Thusday	Today	$ 15.06				(7,530)	7,530	75,300		
5/11/20xx	Friday		$ 16.06	$ 0.20	1,000.00	Credit		8,530			
5/12/20xx	Thusday		$ 16.31	$ 0.10	500.00	Credit		9,030			
5/13/20xx	Saturday		$ 16.01	$ (0.30)	(1,500.00)	Debit		7,530			
5/14/20xx	Sunday		$ 15.85	$ (0.16)	(800.00)	Debit		6,730			
5/15/20xx	Monday		$ 15.95	$ 0.10	500.00	Credit		7,230			
5/16/20xx	Tuesday		$ 15.51	$ (0.35)	(1,750.00)	Debit		5,480			
5/17/20xx	Wednesday		$ 15.65	$ 0.14	700.00	Credit		6,180			
5/18/20xx	Thursday		$ 16.00	$ 0.25	1,250.00	Credit		7,430			
5/19/20xx	Friday	Delivery	$ 16.40	$ 0.35	1,750.00	Credit		9,180			
				sum=	1,650.00					1,650	21.9%

Figure 14.3

The basis is the difference between the futures price and spot price. In general, when the underlying asset's price moves up the futures should move up as well. However, the movement could be inconsistent, potentially creating an arbitrage opportunity. Speculators can take advantage of this and speculate on the **basis which is the differential between the future price and the spot price K-S or S-K**. The basis risk is the risk associated with imperfect hedging. Under these conditions, the spot price of the asset, and the futures price, do not converge on the expiration date of the future. The amount by which the two quantities differ measures the value of the basis risk.

<u>Example of speculating on the basis:</u> *An Investor is holding 100 ounces of gold, who is short one gold futures contract. Suppose that gold today (April) sells for $1,247 an ounce, and the futures price for May delivery is $1,277 an ounce as shown in figure 14.3 above. Therefore, the basis is currently $30 ($1,277 - $1,247). Tomorrow, the spot price might increase to $1,257, while the futures price increases to $1,282, so the basis narrows to $25 ($1282 - $1,257). The investor's gains and losses are as follows:*

Gain on selling of gold (per ounce): $1,257 – 1,247 = $10 and loss on gold futures position (per ounce): $1,282 – 1,277 = $5 which is used for hedging purposes netting a gain of $5 per ounce.

Optimal Hedge Ratio*:*

The Hedge Ratio is a measurement of the size of the position taken in futures contracts to the size of the exposure as follows:

$$h = \rho \frac{\sigma S}{\sigma K}$$

where ρ is the correlation between the spot price (S) and the future price (K), σS is the standard deviation of the spot price and σK is the standard deviation of the futures price.

<u>Example of using the optimal ratio:</u> *A company knows that it will buy 1 million gallons of jet fuel in three months. The standard deviation of the change in the price per gallon of jet fuel over a 3-month period is calculated to be 0.032 (3.2%). The company chooses to hedge their market exposure by buying futures contracts on heating oil. The standard deviation of the change in the futures price over a 3-month period is 0.040 (4.0%) and the coefficient of correlation between the 3-month change in the price of jet fuel and 3-month change in the futures price is 0.8. The optimal hedge ratio is therefore:*

$h = \rho \frac{\sigma S}{\sigma K} = 0.80 \frac{0.032}{0.040} = 0.64$

One heating oil futures contract is on 42,000 gallons (see figure 14.3 under energy futures and heating oil showing 42,000 per contract. The company should therefore buy

0.64 x (1,000,000 / 42,000) = 15.2 contracts (~15 contracts)

3. Futures – Interest Rates

The interest rate future contract is a contract between the buyer and seller (financial institution) agreeing to a set interest rate in the future. The interest rate future can be based on underlying assets such as treasury bills, fed funds, or the 1-month LIBOR traded on the Chicago Mercantile Exchange (CME). Interest rate futures are used mostly for hedging purposes and sometimes speculation purposes. They can be bought and sold on exchanges such as Intercontinental Exchange (ICE) Futures Europe.

Take Treasuries for example. Each future contract size for Treasuries is $100,000. Each contract trades in handles of $1,000, but these handles are split into thirty-seconds, or increments of $31.25 ($1,000/32). Figure 14.2 above shows the June 5-yr Treasury Notes on a contract that is listed as 114-195. This means that the total price of the contract is the face value, plus one handle, plus 19.5/32s of another handle, or:

$$122'5\ price = \$100{,}000 + 1{,}000 + \left(1{,}000\ x\ \frac{19.5}{32}\right) = \$101{,}609.37$$

Each futures contract party has a different view on interest rates and depending on their view they buy or sell futures contracts. **The seller of the interest rate future contract is obliged to borrow money and pay interest. The Buyer of the interest rate future contract is obliged to deposit money and has the right to receive interest.** The price of a futures contracts is derived from the underlying rate of interest (spot rate) and fluctuates along with interest rates. Like bond prices, it is important to understand that as interest rates rise, the market price of futures contracts falls.

For example, let's assume that a particular futures contract allows borrowers and lenders to pay or receive interest at 3%, which is the current market rate of interest available. Let's assume interest rates increase by 1.0% to 4.0%. The 4% futures contract has become less attractive to buy because depositors can earn 4% at the market rate but only 3% under the futures contract. The price of the futures contract must fall. Also, borrowers will now have to pay 4% but if they sell the future contract, they must pay only 3%, so the market will have many sellers and this reduces the selling price until a buyer-seller equilibrium price is reached.

The hedging mechanism works as follows:
An investor of a floating rate loan that earns interest is concerned that interest rates such as LIBOR will fall thus reducing their income. If interest rates fall, futures prices will rise. If the investor is smart, they will buy futures contracts (long position) now and sell later. The gain on futures can be used to offset the lower interest earned.

On the other hand, the borrower is concerned that interest rates will rise and increase their expense. If interest rates rise, futures prices will fall, so the borrower could sell the futures contracts now (short position) and buy later at the lower price.

4. Futures – Foreign Currency Rates

The foreign currency future contract is a contract between the buyer and seller (financial institution) agreeing to a set specific currency rate in the future. The foreign currency future can be based on underlying assets such as the Japanese yen (¥, Canadian dollar, European euros (€) or any other foreign currencies. Currency futures are used mostly for hedging and speculation purposes and can be bought and sold on exchanges such as Chicago Mercantile Exchange (CME). Each futures contract party has a different view on currency rates and depending on their view they buy or sell futures contracts.

For example, let's assume an importer of European goods is vulnerable to currency risk as he needs to convert the US dollar to Euros to pay for goods. In order to hedge his position, he buys (long) the euros at the current exchange rate of 1.15 $/€ and locks it in (see figure 14.4 below). This importer is scheduled to receive a shipment that requires a €1 million equivalent payment so he locks in the currency at 1.15x so the most he can pay is $1,150,000. Each futures contract is $125,000. For $1,150,000 he should buy 8 contracts at the exchange rate of 1.15 (€1,000,000/ €125,000 per contract). Figure 14.4 below shows the hedging helps the importer predict the payment at various scenarios of the exchange rate.

Insert Figure 14.4

FUTURES and FORWARDS

Currency Futures					
	Volume per Contract	Units	Price	$ Change	% Change
Japanese Yen (CME)	¥12500000	$ per 100 ¥	97.2900	-	0.00%
Canadian Dollar (CME)	100,000	$ per CAD	0.7351	0.001	0.14%
Euro (CME)	€125,000	$ per €	1.1523	0.011	0.95%

Purhase Goods in € =	€ 1,000,000
Lock in Exchange Rate - futures =	1.1523x

Transaction on Delivery/Expiration Day	Contracts	EXCHANGE RATES $/€		
Increase/Decrease in Spot Prices		0.10x	0.00x	-0.10x
Scenarios - Spot Prices		1.25x	1.15x	1.05x
Cost of purhasing at the European good at the spot Prices		1,252,300	1,152,300	1,052,300
+ Profit/Loss form Forward Contract	8	(100,000)	-	100,000
Net Payment for the European Goods		1,152,300	1,152,300	1,152,300

Fully Hedged

Figure 14.4

5. Interest Rates Swaps

Interest Rate Swaps are contracts between two parties via a financial intermediary, that agree to exchange (swap) one set of cash flows for another. Since swaps trade over the counter (OTC), the contracts are between two or more parties and are customized based on each circumstance. There are three different types of interest rate swaps: Fixed-to-floating, floating-to-fixed, and float-to-float.

1. **Fixed to Floating**: For example, let's assume a company issued bonds at a fixed interest rate. The company's management feels that it can reduce the payments by entering into a swap agreement that swaps their fixed rate with a net floating rate supporting their view that rates will stay low for a while. In this case, the issuer of bonds can enter into a swap with a counterparty bank in which the company receives a fixed rate to offset their bond coupon payment and pays a floating rate. The swap is structured to match the maturity and cash flow of the fixed-rate bond and these two fixed-rate payments are netted.

2. **Floating to Fixed:** A company that is currently a borrower of a LIBOR floating rate loan and needs access to fixed-rate loan because of concern that the rates will go up can enter a swap to achieve a fixed rate.

Figure 14.5 shows an example of two parties with two different views on interest rates that seek advice from their investment advisor on how to use the swap market to get a better priced loan. This is a case where two parties (A&B) have approached a bank to borrow a $100 million loan. The bank gives them a choice of fixed rate or floating rate shown in figure 14.5 below.

Insert Figure 14.5

Interest Rate Swap

Company A	
Fixed Rate	5.00%
Float (L+)	0.30%
IR View:	Low
Choose:	Fixed
Cash Flow:	
Pay	-5.00%
Pay	-LIBOR
Receive	4.95%
Net Pay	L + 5 bps
Savings	0.25%

Company B	
Fixed Rate	6.20%
Float (L+)	1.00%
IR View	High
Choose:	Float
Cash Flow:	
Pay	-(L+1.0%)
Pay	-4.95%
Receive	+ L
Net Pay	-5.95%
Savings	0.25%

SWAP AGREEMENT - TERMS	
Notional Amount	**100,000,000**
Swap Rate:	**4.95%**
Years	**5**

Figure 14.5

In this case, Party A was given a choice to borrow either 5% fixed or LIBOR + 0.30%. Separately, Party B was given a choice to borrow either 6.20% fixed rate or LIBOR + 1.0%. Party A's view is that rates will stay low so they intend to choose the floating rate while Party B's view is that the rates will go up so it's natural that they should lock in the fixed rate. The investment advisor is recommending that each party chooses the opposite option and enters into a swap agreement to not only achieve their view but also to save on cash flow.

Figure 14.5 shows that despite their view, Party A chose the Fixed rate option and Party B chose the floating rate option. Party A will pay the 5.0% fixed rate to the bank they are borrowing from, receive a swap rate of 4.95% from the swap dealer, and pay LIBOR to the swap dealer, so Party A's net pay is LIBOR + 5 bps derived from 5.0% + LIBOR – 4.95%. Party B will pay the floating rate LIBOR + 1.0% to the bank that it is borrowing from and receive LIBOR from the swap dealer as well as pay a swap rate of 4.95%, Party A's net pay comes to be the 5.95% Fixed payment derived from LIBOR + 1.00% - LIBOR + 4.95% (LIBOR offsets to derive a fixed rate of 5.95%). Both parties benefited from the Swap agreement by 25 basis points. Without the Swap agreement and going with their view, Party A would have chosen LIBOR + 0.30% instead of paying LIBOR + .05% and Party B would have chosen a fixed rate of 6.20% which is higher than the swap agreement at a net fixed rate of 5.95%.

3. **Float to Float**: Companies sometimes enter into a swap to address different maturities that have different floating rates known as a basis swap. A company can swap from one-month LIBOR to three-month LIBOR because the rate is more attractive, or it matches other payment flows.

6. Cross Currency Swaps

Cross-currency swap, or simply, currency swaps, are exchange contracts of interest across different currencies. Interest payments are exchanged at specific set dates through the life of the contract. Companies that have their businesses abroad often use currency swaps to hedge their currency exposure and get more favorable interest rates by borrowing in local markets and using them to swap their payment exposure to the home currency.

Figure 14.6 shows an example of a US company that obtains a loan in Europe to build a manufacturing plant. However, since they will be servicing a loan to start the construction and it is abroad, they will have to convert their debt payments in US dollars to Euros. In such a case where payments such as debt payment will be a large expense, the company will be exploring ideas how to hedge their currency and lock in their expected expenses.

Insert Figure 14.6

US COMPANY (Buisness in Europe)

BOND INFORMATION

Construction Note - Face Value (€)=	€ 100.00	million (Euros)
Euro-denominated Fixed Rate=	6.00%	
Years (Term) =	3	years

SWAP INFORMATION

Spot Exchange Rate=	1.2x	$ per €
Nominal Amount in $	$ 115	million
Dollar-denominated Fixed Rate =	7.00%	

UNHEDGED - WITH A AN EXCHNAGE FUTURE ASSUMPTION

Time	Unhedged Euro Cash Flow (€)	Forward Exchange Rate $/€	Hedges Dollar Cash Flow ($)	Present Value of the unhedged Cash Flows ($)
1	-6.00	1.1500	-6.9	$6.51
2	-6.00	1.1700	-7.02	$6.25
3	-106.00	1.2100	-128.26	$107.69
				$120.45

Benefit = $2.37

HEDGED VIA SWAP CONTRACT

Time	Cash Flow ($)	Hedges Dollar Cash Flow ($)	Present Value of the hedged Cash Flows ($)
1	-8.05	-8.05	$7.59
2	-8.05	-8.05	$7.16
3	-123.05	-123.05	$103.32
			$118.07

Figure 14.6

Figure 14.6 above shows that despite the higher fixed interest rate charged (from 6% to 7%), by swapping from Euro to US dollar today, the US company expects to yield a benefit of an estimated $2.37 million – of course, assuming that the Euro vs Dollar ratio will increase – showing from current levels of 1.15x to 1.21x in 3 years.

Like interest rate swaps, currency swaps have three variations on the exchange of interest rates: fixed to fixed rate; floating to floating rate; or fixed to floating rate. The cross-currency swap opportunity offered to an investor weighs the difference between taking higher or lower interest rate today to hedge the higher or lower movement in the currency exchange.

7. Credit Default Swaps (CDS)

A credit default swap (CDS) is a contract that allows the investor to swap the investor's credit risk with another investor. If an investor that holds bonds is concerned that the bonds will be defaulted, the investor will buy CDS to offset or swap the risk when the bonds do default. The investor that agrees to sell the CDS and receives a premium is obliged to reimburse the investor if the bonds default – this is structured similar to a life insurance policy where the insured pays monthly payment or premium to the insurance company who does not expect that the insured will die anytime soon. In this case, the event is the death of the insured before the payment is made. In a CDS, the event is the default of the bonds.

A credit default swap is the most common form of credit derivative for most bonds including municipal bonds, sovereign bonds, corporate loans and bonds, or mortgage-backed securities - a popular asset class written for the 2008-2009 crisis in the book written by Michael Lewis "The Big Short." Depending on the contract, most CDS contracts are designed so that the buyer of a credit default swap is entitled to receive the par value of the bonds, along with any unpaid interest, if the issuer defaults on the bond payments. CDS, are priced very close to their probability of default. Some investors use CDS to price equivalent bonds.

Figure 14.7 is showing an example where a lender or an investor in corporate loans that holds $100 million in floating rate loans is receiving a rate of LIBOR + 3.0%. The investor in this loan has a few concerns that the loan could potentially be in default and enters into a CDS contract to hedge the risk. The CDS rates offered escalate from 2-4% as the maturity increases from 1 to 5 years calculated based on a duration (not shown here). In this case, the borrower initially receives L+3.0% and pays out 2.0% on a notional amount of the $100 million that matches the direct exposure of the loan. Despite a negative cash flow that the borrower is scheduled to receive in year 3, 4 and 5, the preservation of capital is more important. In this case, the borrower expects a refinancing at par soon or the worst case scenario of a bankruptcy will give the borrower the right to receive par (100%) of $100 million from the swap contract. Please note that the actual LIBOR that the borrower receives is not included in the cash flow assuming that the borrower's cost of capital is LIBOR offsetting that income.

Insert Figure 14.7

Credit Default Swap

Notional Amount = $ 100.00 million

Time (six months)	Lender A receives LIBOR SPREAD	Lender A pays CDS Rate based on Forward Rates	Cash Flow Received from borrower ($ mm)	CDS cost paid to counterter party ($ mm)	Cash Flow Received ($ mm)
0					
1	3.00%	2.00%	3.00	(2.00)	1.00
2	3.00%	2.40%	3.00	(2.40)	0.60
3	3.00%	3.25%	3.00	(3.25)	(0.25)
4	3.00%	4.00%	3.00	(4.00)	(1.00)
5	3.00%	4.00%	3.00	(4.00)	(1.00)

Figure 14.7

8. Valuing Credit Default Swaps (CDS) – John Hall's Method

Most derivative models used for valuing options, futures, forwards, swaps and other derivatives have two items in common: 1. quantifying the payoff based on a probability of an event to incur and then calculate the fair price or the bet today that is in line with such expectation. The Black-Scholes or the Binomial Option Pricing Model, for example, discussed in the last chapter, are modeling examples that are used to value options or future events. There are various methods of valuing CDSs. One that directly addresses the fair value of premiums that an investor is willing to pay today to protect the investment capital in the future is one of many John Hall's simplified credit risk methods. John Hall, an author of various articles and books in the area of derivatives, specialized in credit risk and probability of default concepts.

Figure 14.7 below shows the excel version of John Hall's methodology of valuing CDS in an example with a notional amount of $100 million. Discussed in chapters 9 and 17, the credit risk of an investment is measured by two main variables: Probability of Default and Recovery Rate. These are used extensively to calculate the actual loss or Loss Given Default (LGD) assuming a 3.0% default rate and 70% recovery. As illustrated below in Figure 14.7, the LGD and probability of survival are used to measure the premium that the investor needs to pay to enter into a CDS Contract. In the example below, the CDS annual premium rate, exponentially compounded (e) and paid on a semi-annul basis, is calculated at 92.5 basis points for the next 5 years.

Insert Figure 14.7

	B	C	D	E	F	G	I	J	L	M	N	O
2	**Valuation of Credit Default Swap (CDS) - John Hall's method**											
3												
4	**INPUT**											
5	Notional (N)=		$ 100	million					**PV of Payments = PV of Payoff**			
6	Risk Free Rate (Rf)=		3%									
7	Prob. Of Default (d)=		3%									
8	Recovery Rate (Rec)=		70%									
9												
10	**Payments by CDS Buyer (Buyer of protection)**								**Payoffs by CDS seller (protection seller)**			
11												
12	**PAYMENT**											
13	**Expected Payments**						**Expected Accrual**		**Expected Payoff**			
14	**Time**	**Discount Factor (comp. e) e^{-it}**	**Prob of Survival (p = (1-def)^t**	**PV of Exp. Payments**			**Expected Accrual adj of 1/2 year**	**PV of Exp. Acrrual**	**Probability of Default p.(d)**	**Discount Factor (comp. e)**	**% of Notional p(d) (1-Rec)**	**PV of:**
15	0.5						1.50%	0.015	3.00%	0.988	0.90%	0.009
16	1.0	0.975	97.0%	0.946		=+D16*C17						
17	1.5						1.46%	0.014	2.91%	0.963	0.87%	0.008
18	2.0	0.951	94.1%	0.895								
19	2.5						1.41%	0.013	2.82%	0.939	0.85%	0.008
20	3.0	0.928	91.3%	0.847								
21	3.5						1.37%	0.013	2.74%	0.916	0.82%	0.008
22	4.0	0.905	88.5%	0.801								
23	4.5						1.33%	0.012	2.66%	0.894	0.80%	0.007
24	5.0	0.882	85.9%	0.758								
25			TOTAL=	**4.247**		=SUM(E15:E24)	TOTAL=	**0.066**				**0.040**
26			Plus Accrued	**0.066**		0.066					Per $1 Notional	
27			Total	**4.313**		=+E25+E26						
28												
29			Exp. Payments =	4.313		=+E27						
30			Exp. Payoff =	0.040		=+O25						
			Solve spread (s)									
32			(Exp. Pmt x Spread = Exp./ Payoff)=	0.00925021		=+E30/E29						
33												
34			**CDS Premium (Insurance) Payment**	**92.50**		**bps**						
35												
36												Figure 14.7

Other Derivatives

The main difference between option contracts, described in the previous chapter, and other derivatives such as forwards and futures contracts, is that the buyer of option securities pays upfront to obtain the right to exercise the option in the future to either buy or sell the underlying asset, where in the forward and future contracts the parties are both obliged to sell or buy from each other at a specific date for a specific price. Swap contracts are also different than options as they are contracts that the parties agree to exchange cash flows based on a set interest rate and currency rate today. Forwards, futures and swaps are types of securities that are derived from the direction of other securities such as interest rates, currency rates, commodity prices or index levels.

1. Forward Rate Agreements (FRAs)

Forward Rate Agreements (FRAs) are contracts between two parties that agree on a future rate today and in the future, depending what the market rate is, pays or receives the net difference between the contract rate and the floating rate in the market called the reference rate.

The formula for determining the FRA is below:

$$FRA = \ Notional \ [\frac{(LIBOR - Agreed\ Rate)\left(\frac{m}{360}\right)}{1 + LIBOR\ \left(\frac{m}{360}\right)}]$$

The Agreed Rate is the upfront LIBOR rate (reference rate) that the contract locks-in today and the payoff is calculated at expiration day. "m" represents the reference rate expiration before a reset. Suppose party A takes a long position (receives floating) in an FRA based on a 3-month (90-day) LIBOR that expires in 30 days. The notional amount is $10 million. If the Agreed Rate is 3.0% today, then, in 30 days, the payoff to the holder of the long position will calculate as follows:

$$FRA = \$10{,}000{,}000\ [\frac{(LIBOR - 0.03)\left(\frac{90}{360}\right)}{1 + LIBOR\ \left(\frac{90}{360}\right)}]$$

If the 90-day LIBOR at expiration is 2.0% then the payoff is calculated as follows:

$$FRA = \$10{,}000{,}000\ \left[\frac{(.02 - 0.03)\left(\frac{90}{360}\right)}{1 + 0.02\ \left(\frac{90}{360}\right)}\right] = 10{,}000{,}000\ \left(\frac{-0.0025}{1.005}\right) = \ -24{,}876$$

If the 90-day LIBOR at expiration is 4.0% then the payoff is calculated as follows:

$$FRA = \$10{,}000{,}000\ \left[\frac{(.04 - 0.03)\left(\frac{90}{360}\right)}{1 + 0.04\ \left(\frac{90}{360}\right)}\right] = 10{,}000{,}000\ \left(\frac{0.0025}{1.0100}\right) = \ 24{,}752$$

The party that is long receives $24,752 when LIBOR is at 4.0% (The long investor expects that LIBOR will go up. The short position will receive 24,876 when LIBOR is at 2.0% (1.0% lower than the agreed rate. Figure 14.8 below it shows the positive and negative payoff for the long position.

Insert Figure 14.8

HEDGING AN ANTICIPATED LOAN WITH A FORWARD RATE AGREEMENT

Nominal Value=		$ 10,000,000
Spread =		3.00%
Agreed Rate (LIBOR)		3.00%

LIBOR on Day 30 (%)	FRA PAYOFF ON DAY 30 ($)	FRA PAYOFF COMPOUND TO DAY 90 ($)	AMOUNT DUE ON LOAN ON DAY 120 ($)	TOTAL AMOUNT PAID ON DAY 120 ($)	EFFECTIVE RATE ON LOAN (%) based on 365 days	EFFECTIVE RATE WITHOUT FRA (%)
1.00%	$ (49,875)	$ (50,000)	$ 10,100,000	$ 10,150,000	6.22%	4.12%
1.50%	$ (37,360)	$ (37,500)	$ 10,112,500	$ 10,150,000	6.22%	4.64%
2.00%	$ (24,876)	$ (25,000)	$ 10,125,000	$ 10,150,000	6.22%	5.17%
2.50%	$ (12,422)	$ (12,500)	$ 10,137,500	$ 10,150,000	6.22%	5.69%
3.00%	$ 0	$ 0	$ 10,150,000	$ 10,150,000	6.22%	6.22%
3.50%	$ 12,392	$ 12,500	$ 10,162,500	$ 10,150,000	6.22%	6.76%
4.00%	$ 24,752	$ 25,000	$ 10,175,000	$ 10,150,000	6.22%	7.29%
4.50%	$ 37,083	$ 37,500	$ 10,187,500	$ 10,150,000	6.22%	7.82%
5.00%	$ 49,383	$ 50,000	$ 10,200,000	$ 10,150,000	6.22%	8.36%
5.50%	$ 61,652	$ 62,500	$ 10,212,500	$ 10,150,000	6.22%	8.90%
6.00%	$ 73,892	$ 75,000	$ 10,225,000	$ 10,150,000	6.22%	9.44%
6.50%	$ 86,101	$ 87,500	$ 10,237,500	$ 10,150,000	6.22%	9.99%
7.00%	$ 98,280	$ 100,000	$ 10,250,000	$ 10,150,000	6.22%	10.53%
7.50%	$ 110,429	$ 112,500	$ 10,262,500	$ 10,150,000	6.22%	11.08%
8.00%	$ 122,549	$ 125,000	$ 10,275,000	$ 10,150,000	6.22%	11.63%
8.50%	$ 134,639	$ 137,500	$ 10,287,500	$ 10,150,000	6.22%	12.18%
9.00%	$ 146,699	$ 150,000	$ 10,300,000	$ 10,150,000	6.22%	12.74%

Figure 14.8

Figure 14.8 above shows that if a long position buyer such as the borrower enters into an FRA to lock in the interest rate today (agreed rate of 3.0%), he must believe that rates will rise in the future. The cash difference between the FRA and the 90-day LIBOR rate (reference rate) or floating rate is settled on the value date – in this case 30 days. An increase in rates could be based on the view that the Federal Reserve Bank is in the process of hiking U.S. interest rates based on their monetary policy.

2. PRICING AND VALUATION OF FRAs (VFRA)

The method to price and value these FRAs is illustrated in excel format using the example in below (Figure 14.9):

Insert Figure 14.9

	B	C	D	E
2	**PRICING AND VALUATION OF FORWARD RATE AGREEMENTS**			
3				
4	**INPUT:**			
5	**Description**	**Symbol**		
6	Notional Amount		$ 10,000,000	
7	**LIBOR (spot of h) lets call La**	**L(h)**	**2.50%**	
8	LIBOR (Reference Days)	m	90	days
9	LIBOR (Days FRA exp)	h	30	days
10	**LIBOR (spot of h+m) lets call Lb**	**L(m+h)**	**2.75%**	
11	LIBOR (Days m+h)	m+h	120	days
12	Basis		360	days
13				
14	Days into its life	g	20	days
15	Days remaining (h-g)	h-g	10	days
16	Days of Reference + Remaining	m+g	100	days
17	**LIBOR (spot of h-g) lets call Lc**	**L(h-g)**	**2.25%**	
18	**LIBOR (spot of h+m-g) lets call Ld**	**L(h+m-g)**	**2.45%**	
19				
20	**OUTPUT:**			
21		**Formula**	**Result**	**Excel Formula**
22	**STEP 1 - Solving for the rate of FRA:**			
23	Numerator (N)	**1+(Lb*((m+h)/360)**	1.009166667	=1+(D10*(D11/D12))
24	Denominator (D)	**1+(La*(h/360)**	1.002083333	=1+(D7*(D9/D12))
25	**FRA Calculation**	**(N/D-1)*(360/m)**	**2.83%**	=+((D22/D23)-1)*(D12/D8)
26				
27	**STEP 2 - Valuing FRA durinng its Life**			
28	**Adj for Days Remain (A)**	**1/(1+Lc*((h-g)/360))**	0.99937539	=1/(1+(D17*(D15/D12)))
29				
30	**STEP 3 -FRA Rate Calc**			
31	Numerator (N)	**(1+(step1*(m/360)**	1.007068607	=1+(D25*(D8/D12))
32	Deenominator (D)	**(1+(Ld*(h+m-g)/360)**	1.006805556	=1+(D18*(D16/360))
33	FRA Rate Calc	**N/D**	1.000261273	=+D31/D32
34				
35	**Value FRA (VFRA)**		**$ (8,858.83)**	=+(D28-D33)*D6
36				

Figure 14.9

The example in Figure 14.9 assumes that the following inputs:

- Notional Amount: $10 million
- Reference Index: 90-Day LIBOR
- Days to Expiration: 30 days
- Days into its life: 20 days
- Days Remaining: 10 days
- Market LIBOR Spot rates: 10 Days: 2.25%
  20 Days: 2.45%
  30 Days: 2.50%
  90 Days: 2.65%

120 Day: 2.75%,

The FRA is calculated at 2.83% and adjusted for the 10 days remaining in the contract the contract is valued (VFRA) at $8,858.83 on $10 million notional amount.

3. Swaptions

A swaption is basically structured like an FRA with the exception that the investor has the option and not the obligation to exercise the right to enter an FRA. Like an option, there is a premium paid upfront, strike price, and expiration day. It can be structured as an American option which allows the investor to exercise any time or a European style option which allows the investor to exercise the option at expiration day. Like options, there are call and put swaptions. Call investors become the receiver of swaption and put investors become the payer of the swaption.

The buyer of a call swaption has a view that the interest rates will fall and uses swaptions to swap from a fixed to a floating rate while the buyer of put swaption expects the interest rates may increase and uses swaptions to swap the floating rate to fixed at expiration.

Figure 14.10 below illustrates an example where the investor enters into a swaption for a $10 million notional amount at an 11.5% exercise price. The 11.5% is the rate that the investor can swap out and receive a floating rate of LIBOR instead. The analysis shows the annual premium payments the investor needs to make to keep the swaption is effective based on 3 year forward rates.

Insert Figure 14.10

	B	C	D	E	F	G
2	**SWAPTIONS**					
3						
4	**INPUT**					
5	Notional Amount:	10,000,000				
6	Exercise Rate (X) =	11.50%	Swap to pay and receive LIBOR			
7	1 year (360-Day) Rate=	12.00%				
8	2 year (720-Day) Rate=	13.28%				
9	3 Years (1080-Day) Rate=	14.51%				
10						
11	**OUTPUT**					
12	**Term Days**	**Rate (INPUT)**	**Discount Bond Price**		**R**	
13	360	12.00%	0.892857143	=1/(1+(C13*(B13/360)))	12.000%	=+((1-D13)/SUM($D$13:D13))*360/360
14	720	13.28%	0.790139064	=1/(1+(C14*(B14/360)))	12.469%	=+((1-D14)/SUM($D$13:D14))*360/360
15	1080	14.51%	0.696718456	=1/(1+(C15*(B15/360)))	12.744%	=+((1-D15)/SUM($D$13:D15))*360/360
16						
17	3 Year Swap Rate =		12.744%	=+F15	Swap to pay LIBOR and receive	
18	Less Exerice Price (X)		-11.500%	=-C6		
19	The Net Effect =		1.2444%	=+D17+D18		
20						
21	Payments		$ 124,445	=+C5*D19	per year	
22	PV Payments		$ 296,144	=+D21*(D13+D14+D15)	This what the Swaption is worth at Expiration	
23						
						Figure 14.10

CASE STUDIES AND PRACTICE CASES

Is provided by is a supplemental book accompanied this text book under "Chapter 14 Case Studies and Practice Cases". To access the excel spreadsheet applications used in this Chapter go to www.ProfessorDrou.com under Text Book Spreadsheets.