Security Analysis and Portfolio Management
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Lecture 58
Efficient Market hypothesis-II, Financial Derivatives-I

Welcome back. So, let us continue from where we left off. We now address the common misconceptions about the EMH. And we try to respond to those criticisms.

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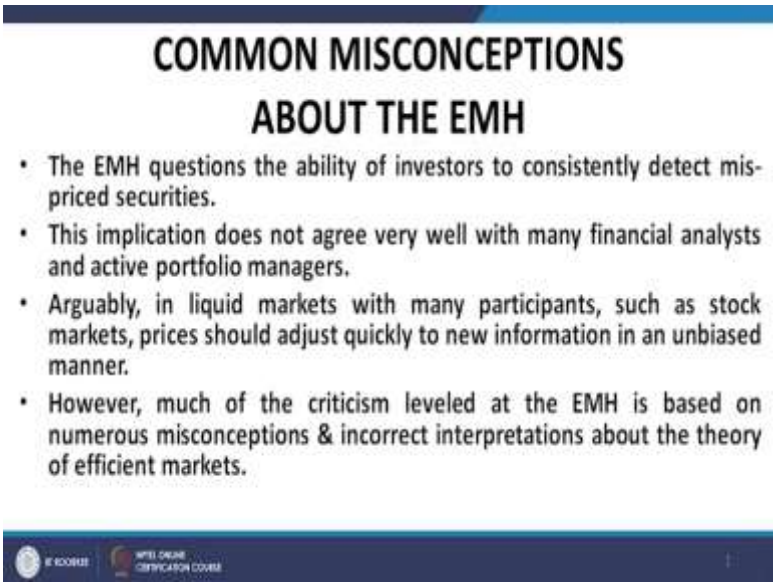

The EMH questions the ability of investors to consistently detect mispriced securities. This implication does not agree very well with many financial analysts and active portfolio managers. Arguably, in liquid markets with many participants such as stock markets, prices should adjust quickly to new information in an unbiased manner.

However, much of the criticism levelled at the EMH is based on numerous misconceptions and incorrect interpretations about the theory of efficient markets. Let us now address those misconceptions.

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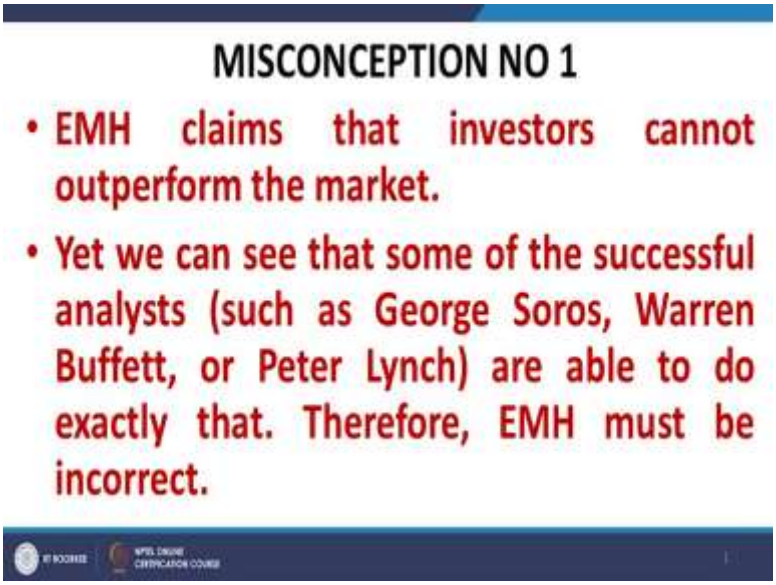

The first misconception is that EMH claims that investors cannot outperform the market. Yet we can see that some of the successful analyst, such as George Soros, Warren Buffet and Peter Lynch are able to do exactly that. Therefore, EMH must be wrong.

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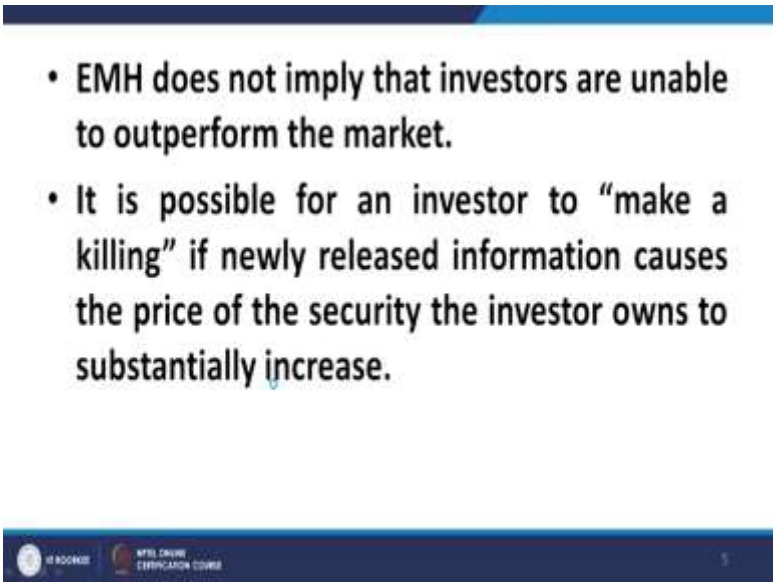

In fact, the EMH does not imply that investors are unable to outperform the market. It is possible that an investor could make a killing if newly released information causes the price of the security the investor owns to substantially increase.

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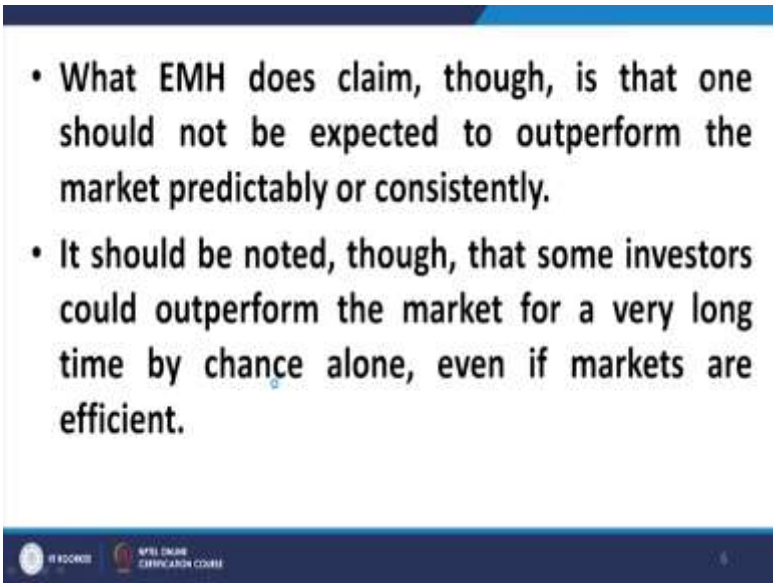

What EMH does claim however, is that, one should not be expected to outperform the market predictably or consistently. It should be noted though some investors could outperform the market for a long time by chance alone, even if the markets are efficient.

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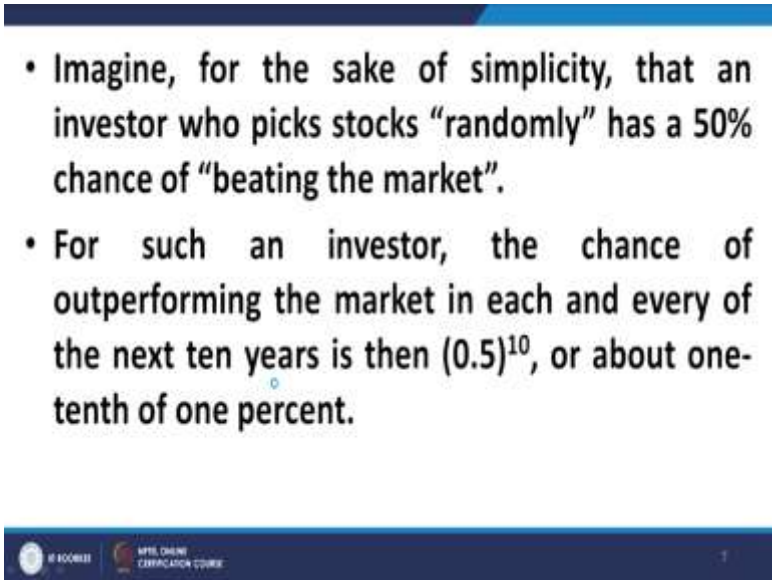

Let us take an example, imagine for the sake of simplicity that an investor who picks stocks randomly has a 50 percent chance of beating the market. Let us assume this, for such an investor the chance of outperforming the market in each and every of the next 10 years is then given by 0.5 to the power 10 or about one tenth on 1 percent.

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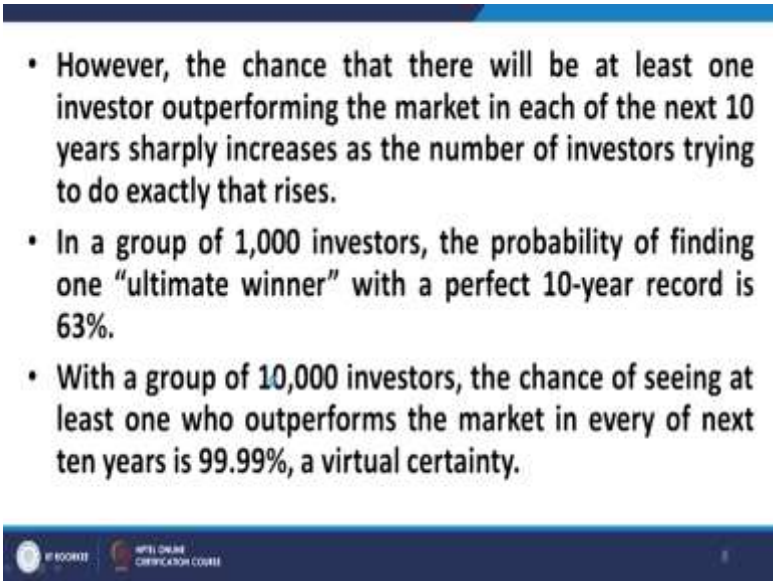

However, the chance that there will be at least one investor outperforming the market in each of the next 10 years, sharply increases as the number of investors trying to do exactly that increases. In a group of 1,000 investors, the probability of finding one ultimate winner with a perfect 10-year record is 63 percent. With a group of 10,000 investors, the chance of seeing at least one who outperforms the market in every one of the next 10 years is 99.99 percent. Almost a certainty.

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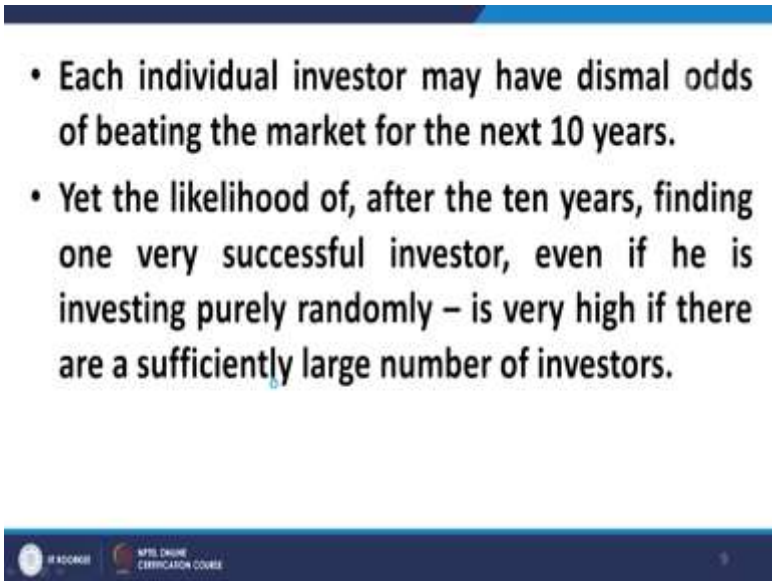

Each individual investor may have dismal odds of beating the market for the next 10 years. Yet the likely hood of, after the 10 years, finding one very successful investor, even if he is investing purely randomly is very high if there are a sufficiently large number of investors.

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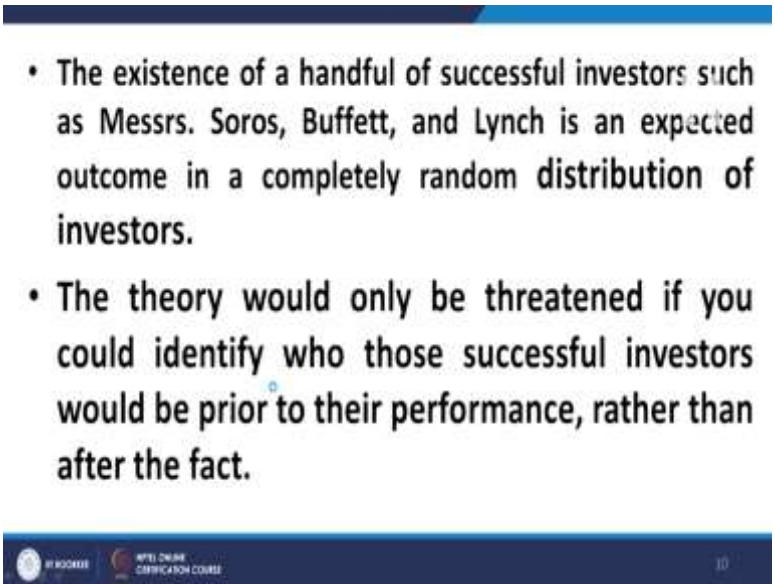

The existence of a handful of successful investors therefore such as Messrs Soros, Buffet and Lynch is an expected outcome of a completely random distribution of investors. The theory would only be threatened if you could identify who those successful investors would be prior to their performance, rather than after the fact.

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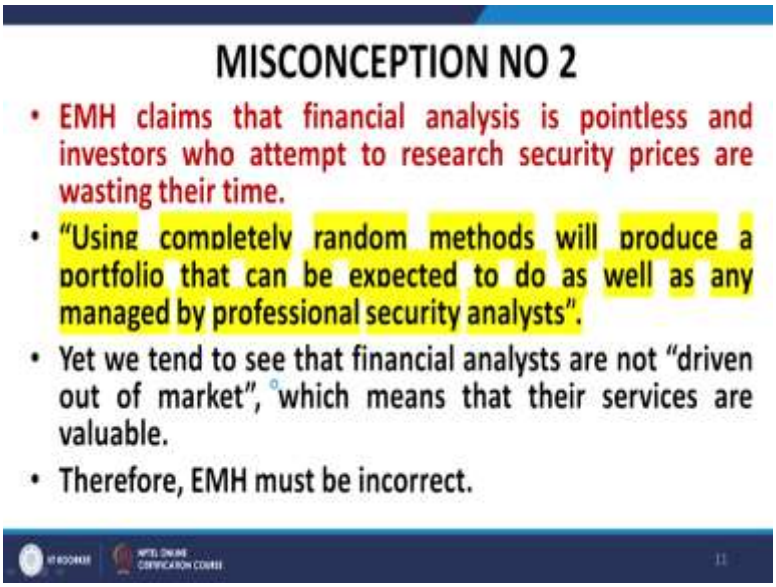

Misconception number 2, EMH claims that financial analyst, financial analysis is pointless and investors who attempt to do research on security prices are wasting their time. Using completely random methods will produce a portfolio that can be expected to do just as well as any managed by professional security analysts. Yet we tend to see that financial analysts are

not "driven out of the market", which means that their services are valuable. Therefore, EMH must be incorrect.

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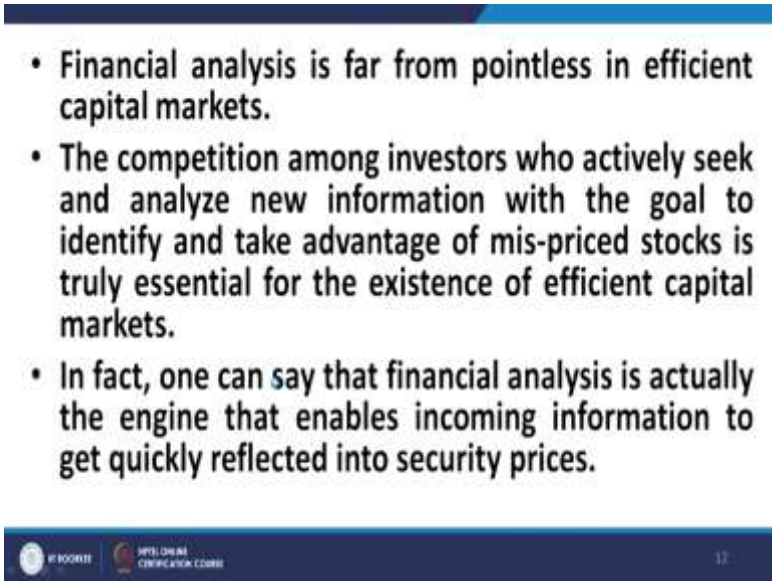

The answer to this misconception or this, the response to this misconception is very intriguing. Financial analysis is far from pointless in efficient capital markets. The competition among investors who actively seek and analyse new information with the goal to identify and take advantage of mis-priced stocks is truly essential for the existence of efficient capital market.

In fact, one can say that financial analysis is actually the engine that enables incoming information to get quickly reflected in security prices. Because it is their analysis that enables them to make rapid trades. The rapidity with which they are able identify mis-prices securities when new information percolates into the market is the, and it reduces the response time.

The faster is the response of the investors or the analysts in identifying mis-prices securities and taking action, the faster would be the response time of the markets recovering to a new equilibrium level.

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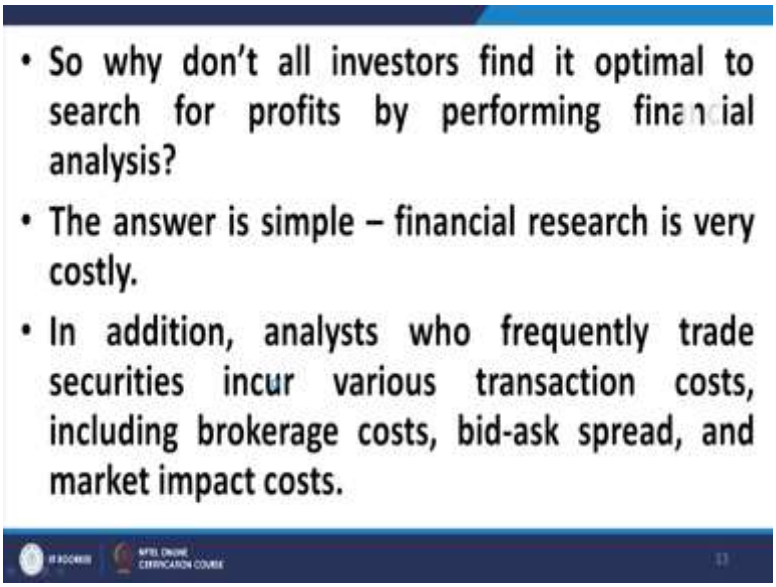

So, why do not all investors find it optimal to search for profits by performing financial analysis? This is a good question. The answer is simple. Financial researchers are very costly. In addition, analysis who frequently trade securities incur various transaction costs, including brokerage, bid-ask spread, and market impact costs.

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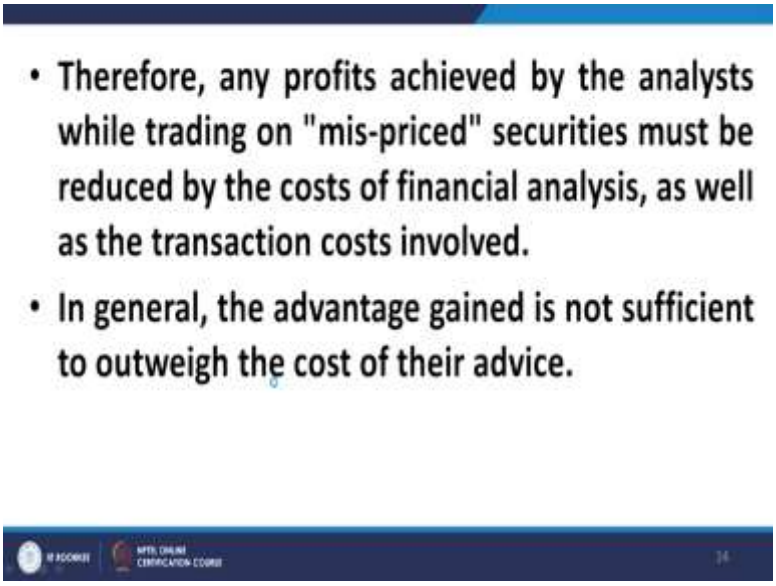

Therefore, any profits achieved by the analysts while trading "miss-priced" securities must be reduced by the costs of financial analysis as well as the transaction costs involved. In general, the advantage gained is not sufficient to outweigh the cost of their advice.

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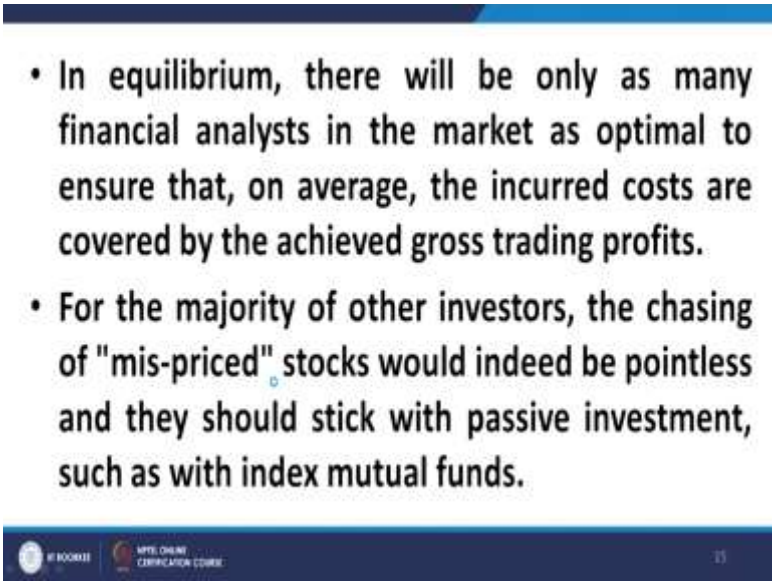

In equilibrium, there will be only as many financial analysts in the market as optimal to ensure that, on average the incur costs are covered by the achieved gross trading profits. For the majority of other investors, the chasing of "mis-priced" stocks would be pointless and they should stick with passive investments, such as with index mutual funds.

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Misconception number 3. EMH claims that new information is always fully reflected in market prices. Yet one can observe prices fluctuating, sometimes very dramatically, every day, hour and minute. Therefore, EMH must be incorrect. Let us see the response.

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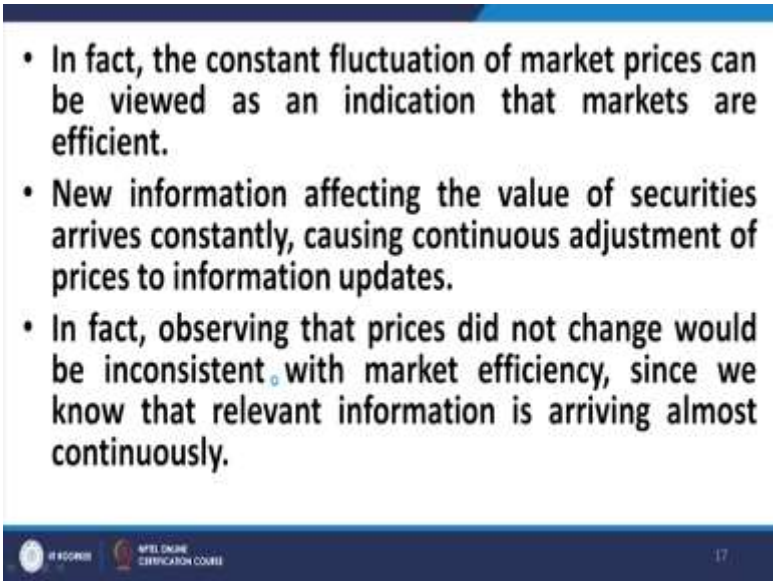

In fact, the constant fluctuation of market prices can be viewed as an indication that markets are efficient. New information effecting the value of securities arise constantly, causing continuous adjustment of prices to information updates. In fact, observing that prices did not change would be inconsistent with market efficiency, since we know that relevant information is arriving almost continuously.

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Misconception number 4. EMH presumes that all investors have to be informed, skilled and able to constantly analyse the flow of new information. Still, the majority of common investors are not trained financial experts. Therefore, EMH must be incorrect.

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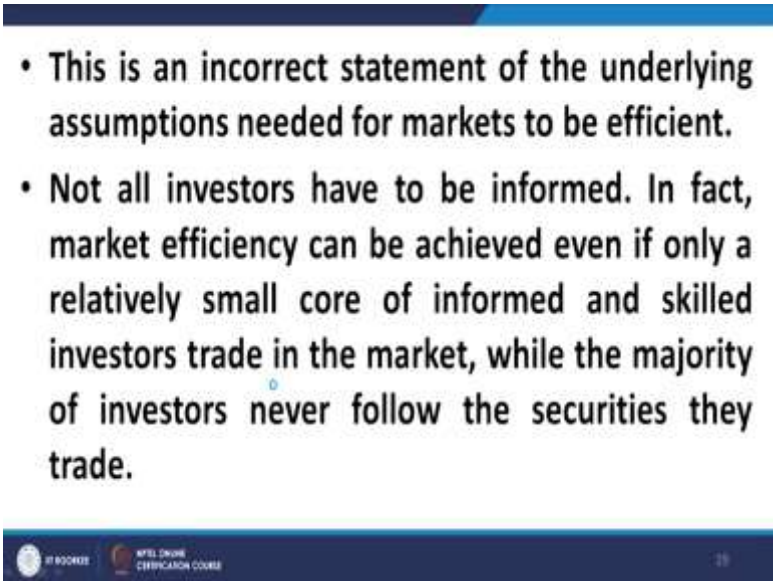

The response is, this is an incorrect statement of the underlying assumptions needed for the markets to be efficient. Not all investors have to be informed. In fact, market efficiency can be achieved even if only a relatively small core of informed and skilled investors trade in the market, while the majority of investors never follow the securities they trade.

So, this is all about the efficient market hypothesis and it has taken up in a lot of detail. I hope the learners find it useful. We now move to the final topic of this course which is financial derivative.

Now, why I have confined only about three lectures to this course, is that there are two courses which are running parallel with this semester's course on security analysis and portfolio management. There is a course by Professor Prabhina Rajeev of IIT Kharagpur on commodity derivatives and there is another course on financial derivatives which is a rerun course of mine.

So, the learners that are interested or intrigued by the concept of financial derivatives, want to learn it detail, can register and enrol for any of these two courses. They will find them much more informative. AT this point I will simply give you a visual of what the financial derivatives looks like and what are the relevant nuances that are restricted with financial derivatives.

So, let us get into them. I have given you a brief touch on financial derivatives in the introduction section of this course. But let us develop that part.

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So, what is a financial derivative? Financial derivative is an instrument whose value depends on, or is derived from, the value of another asset. For example, we have forwards, futures, option, swaps, future options, etcetera. So, basically a financial derivative is a financial instrument, the price of which or the value of which depends on the price or value of some other asset.

And that other asset is called the underlying asset and that other asset may be an induct, maybe a stock induct, maybe a single stock, for example, derivatives on RIL, derivatives od cisco and so on. It may be commodities, for example, corn, maize, wheat, it may be real estate, it may be interests rate like interest rate derivatives.

So, it could be, there is a huge variety, a huge, you know set of assets which can form or on which derivative contracts have been written and are being traded. So, basically to reiterate, a derivative is a financial instrument. The price of which is determined or associated or is linked to the price of another financial asset.

Common applications of derivatives, we have speculation, where a naked position in that derivative, that is like a naked position in any other asset and the investor would take this position, hopes to the market, hopes that his perception of the future price movement of the asset would be different from the market perception and it is his perception which is likely to realise and thereby he would make a profit or he anticipates making a profit.

Edging is a situation where we already have an exposure and we curtail that exposure. In other words, we have an exposure whereby some risk factor when it impacts that exposure it

could result in a price change or a value change which is detrimental to us. And by taking a position in a derivative we want to reduce or eliminate the impact of that risk factor in adversely affecting the price or value of our exposure.

Arbitrage is a situation where different prices of similar assets or same assets exist in different markets. And whereby, by taking opposite rate we can make a riskless profit. Changing the value of assets and liability, this will, this is typically demonstrated by the interest rate swaps where fix rate borrowing is converted to of routine rate borrowing and vice versa.

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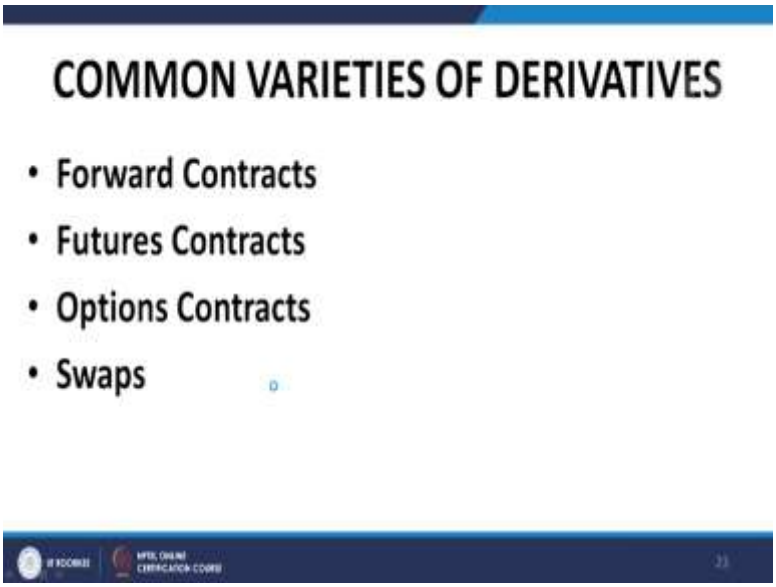

Common varieties of derivatives I have already mentioned, forward contracts, futures, options and swaps and then we have multiple combinations of these derivatives. We have future options and so on, even option we have a huge variety. So, that is obviously beyond the scope of this course.

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Now, talking about forward contracts, what are forward contracts? Firstly, forward contracts are customized contracts. We have two relevant dates in the context of the forward contracts, we have today which is the date on which the contract id negotiated which is t is equal to 0. The price is agreed upon at t is equal to 0. All the other terms of delivery are agreed at t is equal to 0.

In fact, all the terms that are required for an unambiguous settlement are agreed upon at t is equal to 0, including price delivery, terms delivery instruction, the quality of the underlying asset, everything is agreed at t is equal to 0. But the actual settlement of the contract, the actual delivery of the underlying asset and the payment of the price therefore takes place at the future date.

That future date is also agreed upon at t equal to 0. In fact that is called the maturity of the forward, that is predetermined. However, the settlement of the contract as I mentioned takes place on a specified future date, specified, please note that. It is also agreed at t equal to 0. The settlement date is also agreed today.

Cash lockers in the future, no cash lockers at a point, at the point of negotiation of the contract, of course bankers may require certain amount of deposited a way of margin in the way form of fixed deposit assets or some other form of deposit. But that does not pertain to the direct nexus, that does not have a direct nexus with the forward contract that is in relation to the possibility of default on the forward contract. Since forward is a private contract, the susceptibility of default exists or the possibility of default exist.

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Futures contracts are slightly different. Futures are in a sense similar to forward contracts. In the sense that they are also contracts with two relevant dates, a t is equal to 0 at which all the term in relation to the settlement at t equal capital T which is the maturity are agreed upon a date of maturity, the price at maturity and the terms of delivery, the quantity and the method of delivery, everything, the method of settlement of the contract. If it is be cash settled for example, everything is agreed at t is equal to 0.

And the actual settlement of contract is at t equal to capital T. The maturity of the futures contract. So, to that extent they mimic absolutely the forward contract. What is different though is that two fundamental properties, the fact that they are tradeable and the fact that they are, no the fact that they are tradeable in fact resolves in two properties.

Number 1, that they are standardized, so that there exists an adequate liquidity in the market. Number 2, there is a proper risk management mechanism so that the performance on the futures contract is default free. Because if there was a default risk in the futures contract it would inhibit trading and a mechanism is put in place to eliminate any risk of default. We will come back to it.

So, since futures are exchange traded, they are standardized to facilitate liquidity to enable uninhibited trading. The exchange is clearing out guarantees, performance oppose of this contract. These contracts are in negligible defaulter risk. The exchange product itself by imposing MTM and margining. So, I will talk about MTM and margining at a little point in time.

So, forward sources futures, forward is a private contract, forwards are customized, forwards carry one specified date, usually forwards at settled at maturity by delivery or cash settle, usually forward carry some credit risks. Futures are exchange credit contracts, futures are standardized, futures may carry one or more of a range of specified delivery dates, futures are settled daily by marking to market, futures are usually closed or before maturity, futures carry virtually no default risks. Now, we talk about option contracts.

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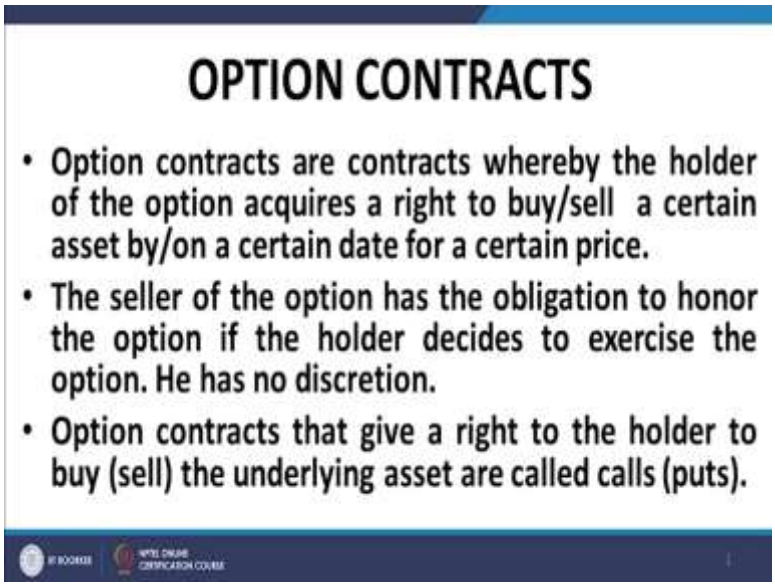

Now, you see in the case of forward contracts and in the case of future contracts there exists, once a contract is agreed upon and once a contract is negotiated at t is equal to 0 and agreed upon then both the parties have their respective obligations.

Party A for example is required to pay the certain amount of money and party B is required to deliver the underlying asset to party A. So, there are obligations on both the parties and so far as the contract or the execution or settlement of the contract is concerned. However, when we talk about options it is slightly different, again we have two parties but in this case one party has the right and the other party has the obligation.

Let me repeat, one party has the right either to buy or sell the asset at a predetermined point in time, at a predetermined price, both of which are greed upon t is equal to 0. So, one party has the right either to buy or to sell an asset at a future point in time at a price which is agreed upon at t is equal to 0.

Both the terms, the maturity as well as the price are agreed upon at t equal to 0. But the other party, this is the fundamental difference, the other party has the obligation, if the party A

exercises the right that he is invested with by virtue of buying the option, the party who has sold the option has the obligation to deliver the asset. If it is an option to buy the asset or to buy the asset, if it is an option to sell the asset.

So, the basic thing is that in the case of an option contract the relation, the difference between this and forwards or futures is that, one party has the right the other party has the obligation and therefore because one party is at a superior pedestal, the other party is at a lower pedestal, he has a right, he has no rights, he has the obligation.

Therefore, the party who has the right must compensate the other party by a certain price which is called the premium on the option or the price at which the option is bought. The party who has bought the option contract is said to have the right or is the party that has the right. The party who has sold the option is said to have the or has the obligation rather embedded in the option contract.

So, option contracts are contracts whereby the holder of the option acquires a right to buy oblique sell a certain asset by or on a certain date for a certain price. All this is pre-agreed, and I reiterate that this is part of the option contract which is initiated at t equal to 0. The seller of the option has the obligation to honour the option if the holder, if the buyer of the option, that is the holder of the option, that is also called the party long in the option, the seller of the option is called the writer of the option is also called the party short in the option.

So, the seller of the option has the obligation to honour the option if the holder decides to exercise the option, he has no discretion, the discretion rests with the buyer of the option, he may exercise the option, he may let the option lapse, of course if he lets the option lapse, he loses the premium. But that discretion is wasted in him that he can allow the option to lapse or he may exercise the option and impose the right embedded in the option contract.

The seller of the option has the obligation to honour the option if the holder decides to excise the option, he has no discretion. Option contracts that give a right to the holder to buy oblique sell the underlying assets are called calls or brackets puts. So, the right to buy is called a call option the right to sell is called a put option.

If the option buyer, if the option holder or if the party long in the option has the right to buy or the option contract embeds a right to buy an asset at predetermined price on a predetermined date, it is called a call option. And if the contract has a right to sell then it called a put option.

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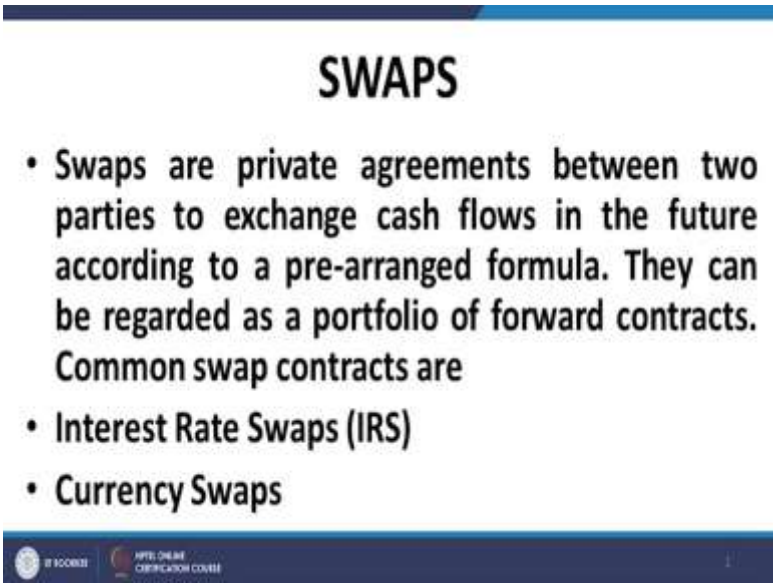

Swaps are private agreements between two parties to exchange cash flows in the future according to a pre-arranged formula. They can be regarded as portfolio of forward contracts. Common swap contracts are Interest Rate Swaps, which are alluded to a bit, little bit earlier and Currency Swaps.

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So, now we talk about forward contracts. What is the terminology in relation to forward contracts? The underlying asset is the asset that forms the substratum of the forward contract which is the asset that is to exchange under the forward contract. The party who is long in the forward contract will buy the asset from the party who is short in the forward contract, which asset, that asset is called the underlying asset.

Maturity, the date on which the forward contract matures for execution or the date on which the contract is to be settled. I repeat this date is also fixed at t equal to 0. Forward price, it is a price at which the forward is to be settled, it is the price that is agreed upon at t equal to 0 but the actual payment of the price takes place on maturity.

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Long and short positions. Now quickly let me refer to this technical terminology. Underlying asset in so far as long and short position in the underlying asset are concerned, a long position in an asset means owning the asset. Shorting the asset means borrowing the asset. As far as the forward is concerned the entity who buys the asset under the forward contract, buys the underlying asset under the forward contract is said to be long in the asset. The party who delivers the asset under the forward contract is said to be short in the forward contract.

So, as far as the option is concerned, the party who buys the right is said to be the long is the option and the party who sells the option is said to be short in the option.

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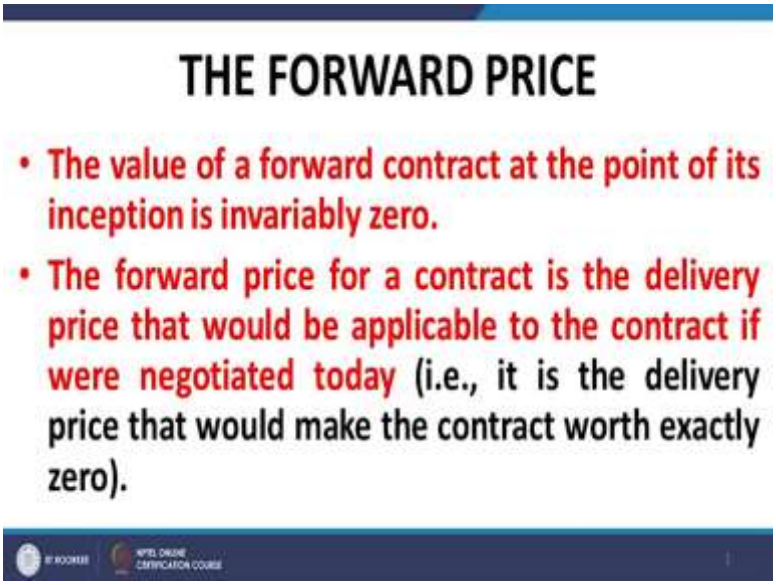

The forward price, the value of a forward contract at the point of inception is invariably zero. Now, here I want to make a slight digression. I need to tell you the difference between the value of the forward price and the and the value of the forward contract. Now, as far the forward price is concerned it is quite simple, just like we have this spot price, we have talked about it in a lot of detail, what is this spot price?

The spot price is the price that you pay when you go to the market and buy an asset. You pay the price, you buy the asset, that is the spot price. Now, as far as the forward price is concerned, what happen. You and I agree today that I will deliver you a certain amount, a certain asset, I say three months down the line at a point which is agreed upon right now, this is called the forward price.

The price which is agreed upon at the inception of the contract at which the delivery is likely to place, delivery is supposed to take place on the date of maturity of the forward contract. But there is a certain thing called the value of the contract. The value of the forward contract, suppose today you and I enter into a forward contract, for example I am to deliver against this forward contract, you are to deliver me 500 dollars, I am to pay you say 50000 rupees say at the end of three months from now.

At this point the value of this contract is 0. Both of us have agreed upon this today and at this point the value of the contract is 0. Because these fifty thousand rupees for five hundred dollars would pretty much reflect the current rate, market rate in the context of delivery at the end of 3 months.

So, at this point this is the forward price, this is called the forward price. However, as we move forward in time, say tomorrow, day after tomorrow, 15 days down the line, 1 month down the line, the market perception about the exchange rate between US dollars and Indian rupees will change. And as a result of which maybe the dollars would become dearer or maybe the rupees would become dearer and you have to pay less rupees for the dollar. That would cause the contract that you and I have entered into at t equal to 0 to acquire a certain value.

In other words, if wither of us were to get out of the contract and assign it to a third party then price or the amount of money that the third party would either receive or pay depending on who is exiting and the new relationship between, new exchange rate is called the price of the forward contract or the value of the forward contract. So, there is a difference between the forward price and the value of the contract.

The value of the contract is a value ascribed to a composite contract comprising of both the legs and when there is a transfer of the contracts or the assignment of contract from one party to another. However, as well as the price is concerned, it the price that one party pays for acquiring the underlying asset under the forward contract and obviously this price is undetermined by the market and is indeed is the price or the value of the forward contract.

So, that is the difference between the value of the contract and the forward price. We shall talk about quickly; we shall talk about how the forward value of a forward contract is determined. So, the forward price of a contract is the delivery price that would be applicable to the contract if it was negotiated today, that is, it is a delivery price that would make the contract worth exactly 0.

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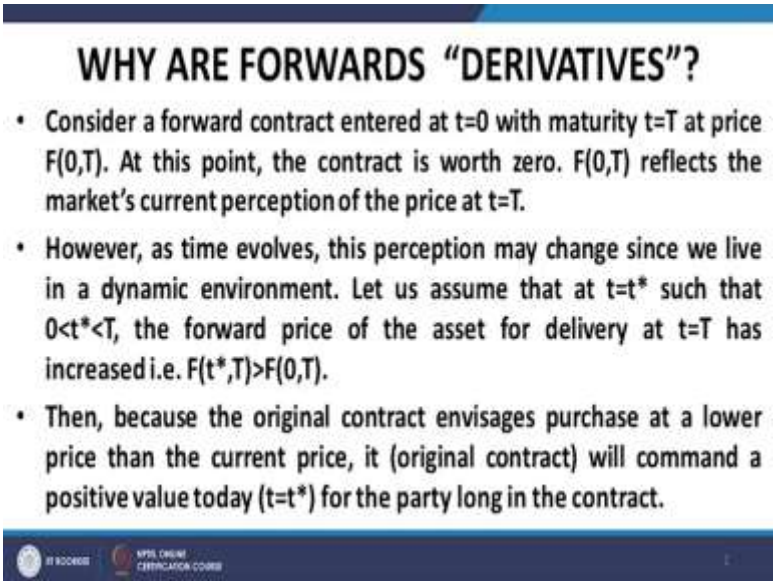

Now, why are forward derivatives? Well as I mentioned depending on the, carry forward the example that I mentioned just now. As time passes, let us say t equal to 1 day, 2 day, 15 days, one month, the perception about the exchange rate would between you as taller and Indian rupees changes and as a result of which the contract that you and I have entered into acquires a value.

That means what, that means contracts, forward contract is acquiring a value based on the changes and exchange rate. As the exchange rate changes this contract will acquire either a value for me and a value for you. Of course, it is a zero-sum game. So, the point is as the exchange rates change down the line during the life of the forward contract, the value of the contract changes. And that is why this forward contract is classified as a derivative contract.

Why, because the value of this forward contract is dependent on what, it is dependent on the exchange rate that prevails in the market at any point in time.

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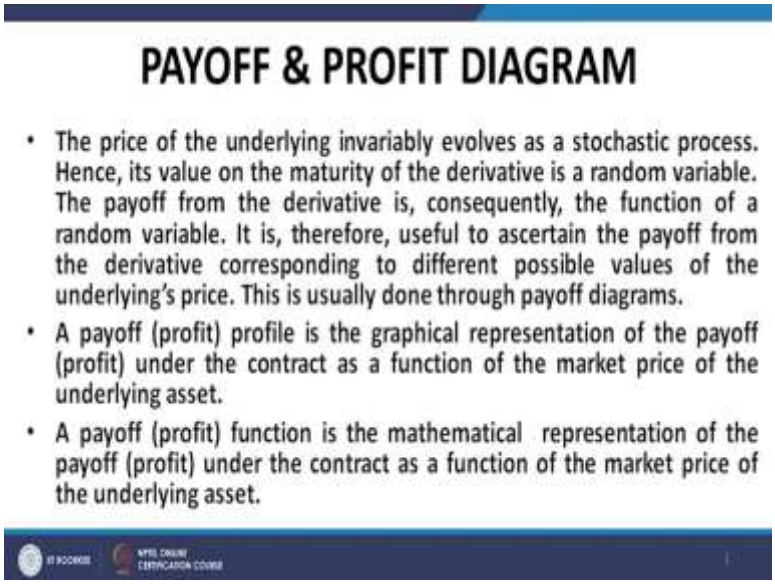

Now, payoffs and payoffs diagrams. Now, you see the point is the date of maturity of all these derivative contracts is in the future. And as you know prices are not absolutely predictable so far as future is concerned, at least most of the authors, you may have a risk-free bond but other than that prices of most of the financial assets are not absolutely predictable as on the date of maturity of derivatives. They are in fact random variables.

Now, that being the case what we try to do is sitting here at t equal to 0 or at any earlier point in time between t equal to 0 and t equal to capital T which represents the maturity of the derivative. We want to asses or evaluate what kind of payoffs we are going to get or what kind of money flow is likely to take place on the date of maturity of the derivative contract. This is captured by something which is called the payoff profile or the payoff function.

The payoff function or the payoff profile as you may say is the, pay off profile is the graphical representation and pay off function is the mathematical representation of the flow of money or the relationship between the price of the underlying asset on the date of maturity of the derivative, which is a random variable and the excise price or the price at which the derivative has to be settled.

So, let me repeat, the payoff profile or the payoff diagram or the payoff function are representations, either graphical or mathematical of the relationship between the various possible values or the spectrum of values that the underlying assets, the price of the underlying assets could take on the date of maturity of the instrument and the payoff from the or the excess price of the derivative. So, these are called pay off functions, we will take examples of them in the following slides.

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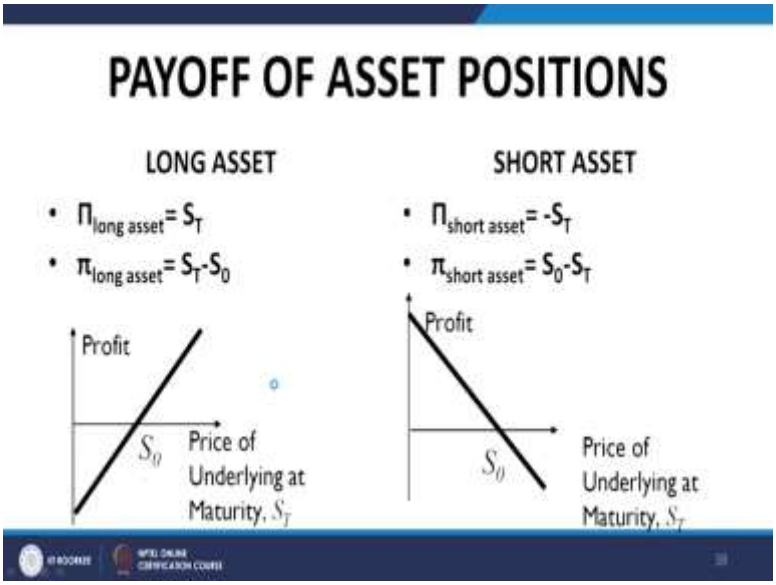

Now, this is the payoff of an asset position, pure asset position, naked asset position. Suppose you are long in a particular asset, suppose you bought the asset at S0, you bought the asset at T equal to 0 at a price at 0. And let us say on the date of maturity the price is ST where ST is obviously a random variable. Then the profit from the asset that we are going to get is ST minus S0 which is what you see here in this left-hand side panel which is in the left-hand side panel.

It depicts ST along the x axis and the profit that is St minus S0 along the y axis. Clearly it is a 45-degree line and if the value of St turns out to be 0, the entire S0 is a loss and which is represented as a y intercept. Similarly for a short asset it is a mirror image because long and short positions are basically a zero-sum game. So, as far as the depiction of the long and short positions are concerned, they mirror images of each other.

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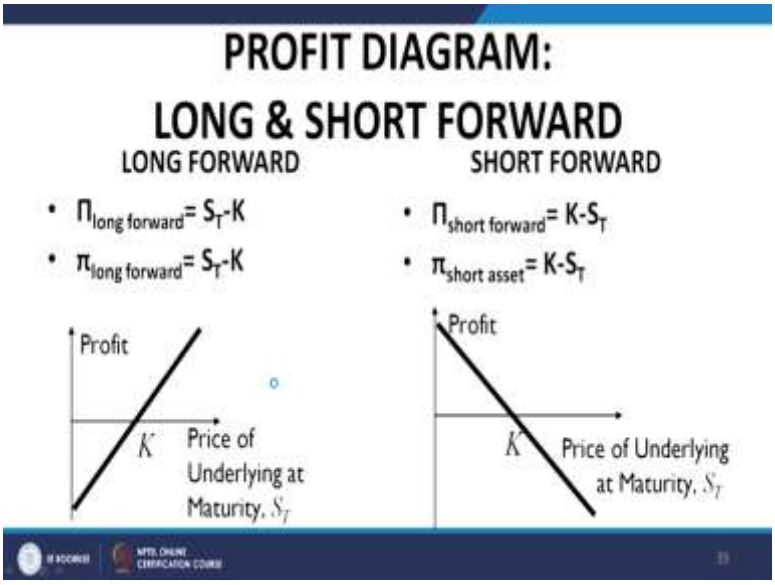

Now, as the payoff diagram of a long and short forward. As you know the forward contract entails the delivery of the asset at a fixed price which is determined at t equal to 0, let this price be K. Let this price or the underlying price of the forward price on the date of inception of the forward contract be K which is to paid say at time capital T when the forward matures for getting the underlying asset.

Now this underlying asset, when I acquire this underlying asset under the forward contract I can sell it in the market, I can sell it in the market at what price? I can sell it in the market at the price ST. Therefore, ST minus K would be my profit or would be my net catch, my net catch would be my net catch flow under the forward contract.

So, this graph represents that particular situation, if I am long in the forward contract and obviously if I am short in the forward contract the mirror image would be the graph or the payoff diagram of the short position. It would be K minus ST and we have ST minus K for the long forward position.

So, I will acquire the asset at K, I will sell it in the market at ST and make a profit or the net catch inflow to me would be ST minus K which is represented by left-hand panel. And if I am short in the asset, then I will have to deliver the asset at K, I have to buy the asset at ST, so my net cash flow is K minus ST which is represented in the right-hand panel.

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Now we talk about no arbitrage pricing of forward contracts. Let us look at the simplest case. In the simplest case what we assume is that there is no income from the underlying during the forward, no carrying cost of underlying during the period, no transaction costs and other market frictions.

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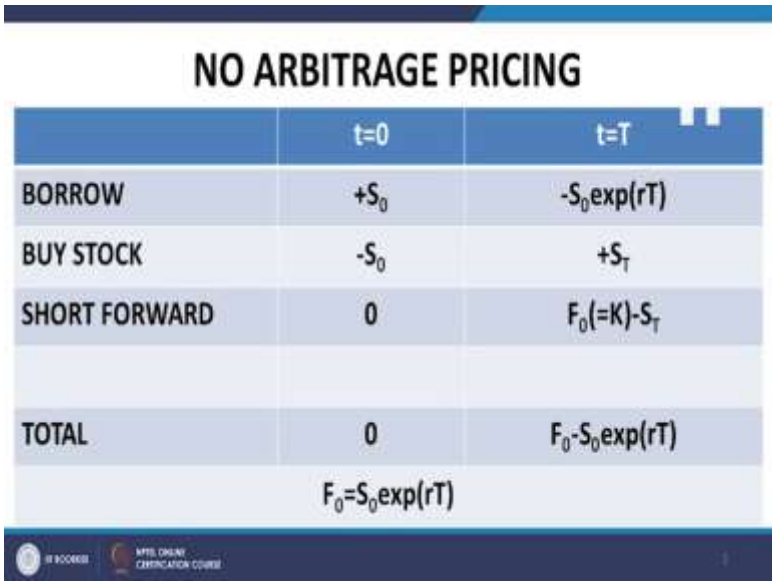

So, let us now look at a situation. Let us say at, we are at t equal to 0 and let us investigate this situation, what will happen at t equal to capital T, which is the maturity of the forward contract. Let us assume that I do this set of transactions which are represented in the left-hand column.

I borrow a certain sum of money which is S0. Borrowing this sum at the risk free from a bank or a financial institute or other Lender at the risk-free rate, I borrow an amount S0.

What I do with this S0 amount of money, I buy one unit of the underlying asset. So, if the market price of the underlying asset at t equal to 0 is S0 then I pay a zero and I buy the asset in the spot market by paying this S0 and getting one unit of the underlying asset.

At the same what I do I take a short position in the forward contract on one unit of the underlying asset that I bought it at S0. In other words, I take a short position on the asset which I have bought already by paying an amount S0 which I borrowed from the bank. So, now please note as I mentioned in the case of a short, in the case of a forward position or taking of a forward position there is no cashflow at t equal to 0 and therefore that is represented at t equal to 0 by 0.

What happens at maturity? At maturity what will happen, I will deliver the asset under the short forward contract and I will receive the price of the asset which is K. I will receive the forward price of the asset please note this, which is K, which is agreed upon at t equal to 0 when I enter into the short position in the forward contract.

So, my net flow at t equal to capital T, that is the maturity of the forward contract will be K minus ST or F0 minus ST, assuming that we represent K by F0 which is the forward price at t equal to 0. So, the cash flow on account of the short forward contract is F0 minus t. I receive the money and if I have to buy the asset from the market, I will have to pay ST and receive F0.

Now, what about the money that I have borrowed? Now I have borrowed an amount, S0 at t equal to 0, I have to repay that amount together with interest, so that will become what, that will become S0 exponential Rt. So, this is the amount that I have to repay to the bank against for borrowing of S0.

And what about the asset one unit of the share, one unit of the asset that I have already bought at t equal to 0, I can sell it in the market at St or equivalently I can use that one unit of the asset to deliver it under the forward contract, either way it comes to the same thing because we are ignoring transaction cost.

We assume that the transaction cost is 0. So, either I use that one unit of the asset that I have with me to deliver it against the forward contract and receive the money F0 from the other party who is long in the forward contract. And so, I have an amount F0 with me or I can also

sell this underlying asset in the market and then buy the underlying asset and deliver it under the forward contract, either way the net cash flow remains unchanged.

So, this is the overall situation that arises at t equal to capital T is the net cash flow is F0 minus S0 exponential RT. Now look at the two situations. Number one at t equal to 0 there is no cash outlet, number two then, we have assumed that the forward is default free. We have also borrowed at the risk-free rate. So, the net result is that there is no incremental risk arising from this set of transaction.

There is no additional risk taken by the party or the arbitrager who is indulging in this transaction. Therefore, the cash flow at t equal to capital T must also necessarily be 0. I repeat number one, there is no cash outflow at t equal to 0. Number two, we are not taking any risk in this process, we are not taking any incremental risk under this set of transactions represented at t equal to 0 assuming that the forward is default free.

And therefore, the net cash flow at t equal to capital T must be 0 and that gives us the no arbitrage value of the forward contract at t equal to 0 as F0 is equal to S0 exponential Rt. We shall continue from here in the next lecture. Thank you.