Behavioral and Personal Finance
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Module - 01
Behavioral Economics and Finance
Lecture - 11
Prospect Theory and Behavioral Finance (Contd.)

Hi there, welcome back to the course Behavioral and Personal Finance. So, far we have discussed about the standard utility theory and how prospect theory is deviating from the standard utility theory in terms of considering decision making scenario with risk and uncertainty. Earlier we have discussed the implication of behavioral biases in standard financial decision making and we have also touched upon various issues and factors that might affect the decision making with respect to asset pricing, corporate finance and personal finance.

In today's session we will discuss about how these factors affect the market efficiency hypothesis which is basically the backbone of finance theory. And, we will also try to understand in mathematical terms how this irrational behavior of investors or deviation from the expected utility theory can influence the return generation process in financial markets.

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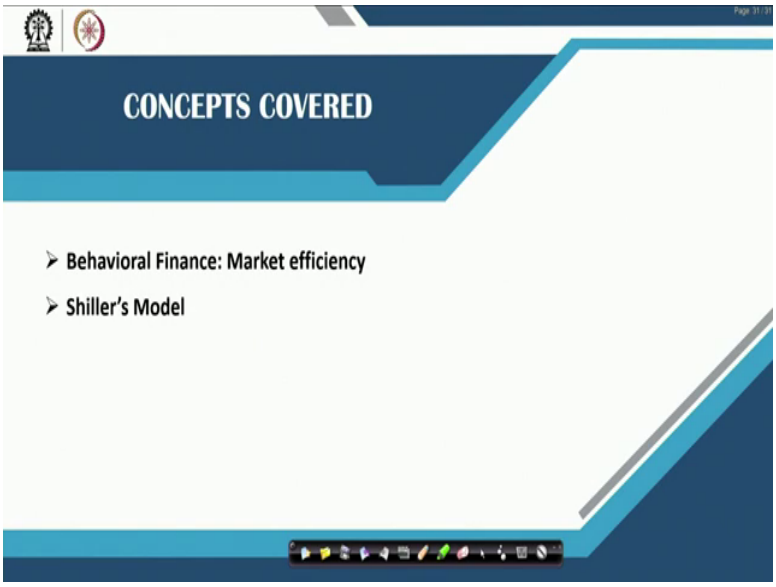

The topic that we are going to discuss today are the market inefficiency or rather the issues with market efficiency hypothesis in the context of behavioral finance. And we will also discuss in this session some basic mathematical framework of Shiller's model.

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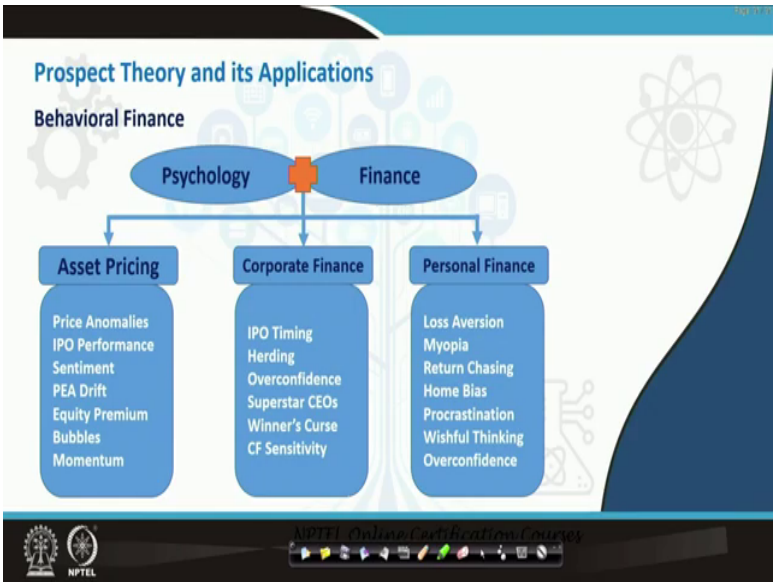

In last session we had discussed how psychology when mixed with finance effect the decision making in financial markets where we see the economic agent suffering from several biases in terms of in appropriate valuation of financial assets and in corporate finance context taking suboptimal financial decisions and similarly in personal finance context individual investors and retail investors suffering from several behavioral biases and heuristics.

If you look at the standard finance theory, most of the theories are based on some standard economic assumptions where economic agents, that is individuals are supposed to undertake decisions which are in their based interest.

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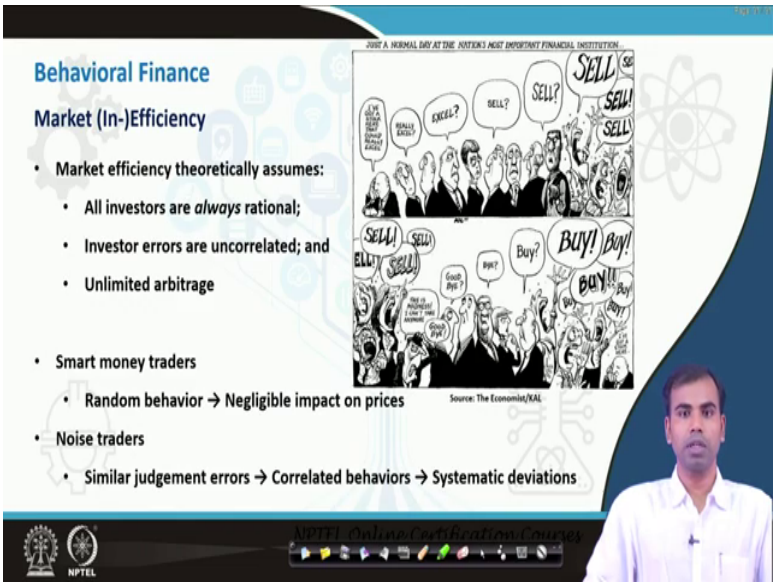

Basically the major assumptions of efficient market hypothesis are as follows: all economic agents basically in terms of financial markets these are investors are always rational, which implies that they always consider all the information and make decisions which are in their based economic interest.

Another assumption based on which efficient market hypothesis was developed is that investors errors are uncorrelated, this means that when there are some investors who make some mistakes on the positive side, there are similar set of investors who make in mistakes on the negative side and thereby the mistakes are cancelled out and effect on the prices are very negligible. And, another assumptions based on which the efficient market hypothesis was proposed is unlimited arbitrage.

This particular assumption assumes that markets offer unlimited arbitrage opportunities to investors and those with arbitrage opportunity can make suboptimal returns and thereby can beat the market in long run. But, when we talk about market as a whole we know that there could be several types of investors in the markets. If we keep it simple and start with the assumption that markets comprises of two major categories of investors, one being smart money investors and second noise traders.

So, smart money investors are those people who consider all the information into their decision making process, they always rely on research and analysis before they take final decision. And they incorporate all information available and arrive at the right valuation of the financial assets that they consider for investing or buying, which means people's behavior are uncorrelated and their decisions are random in their own context and that will lead to negligible impact on prices of securities. Securities here implies the assets of financial natures such as stocks, bonds and other financial securities.

The other set of investors who are active in stock markets are noise traders, noise traders are those people who take their investment decision based on some heuristics or intuition or guts. They really do not care about the information that they can get or the research or advice that they can obtain from different reliable sources.

One example could be housewives trading in stock markets, they probably would not like to go into detailed research of any company and rather go with the gut feeling before they invest in any stock. Such investors basically follow similar psychology that result in similar judgment errors, when there are judgment errors of similar nature in large volume that will result in correlated behavior and that will further lead to the systematic deviation from the normal.

Basically, it implies that when there are too many people behaving in a similar fashion that will lead the valuation or the prices of financial securities in a particular direction and that deviation from the standard or the normal would probably be not justified by the fundamental data. These two set of investors when interact the markets show a different characteristics.

Smart money investors always rely on financial assets with fundamental valuation whereas, noise traders rely on news information by biases, heuristics, rumors or anything that comes in their decision making process.

One example: if you recall we discussed in the very beginning of this course was how information travel from one corner of the market to another corner and how it deviate people from taking the right decision. If you remember this example we understand that when people get access to information they interpret that particular information in their own way. And, in the process probably sometimes they make mistakes which are systematic and when there are several people of this kind that will drive the market towards a rational valuation.

One of the basic arguments that a Robert Shiller give was how these irrational investors or the investors with irrational expectations and valuation could affect the pricing of the market and that makes the situation for rational investors who are basically in terms of Robert Shiller smart money investors valuation even more difficult.

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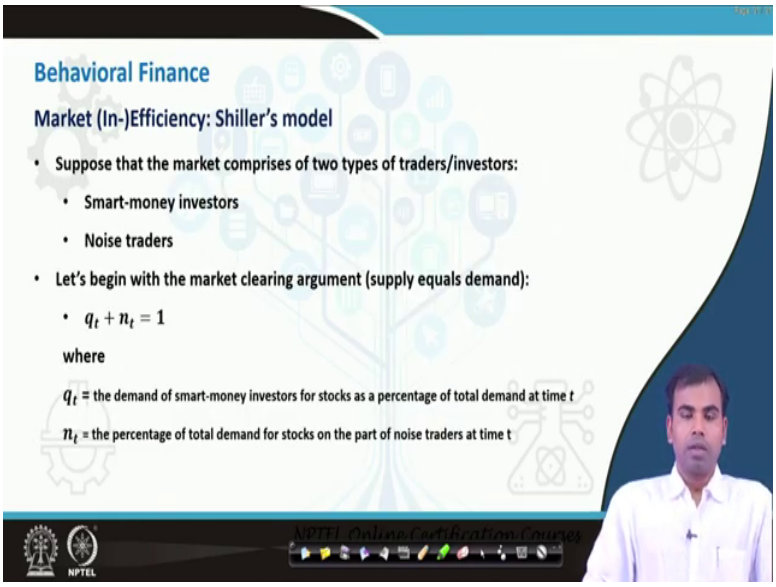

When we talk about Robert Shiller model of financial asset pricing we will start with the assumption that market comprises of two major sets of investors, smart money investors and noise traders and going by the standard economic rule the that suggests that supply equals demand we can understand that the market clearing argument would lead us to explain this in a very simplistic framework such as q t plus n t is equal to 1, where q t is basically the demand of a smart money investors for a stocks as a percentage of total demand at time t and similarly n t represents the percentage of demand for stocks by the noise traders at time t.

If I try to explain this particular framework in more detailed way we will get to understand how smart money investors would find it difficult to find the right valuation of any financial assets given that noise traders behave in a very systematic erroneous way and that makes the whole pricing framework even more difficult. Let me try to show you this particular equation in a more detailed way that will help us to understand how investor sentiment or rather

investors behavior would become an important input for pricing of the financial assets that we are considering for investment.

So, I was telling that according to Shiller's model the market comprises of two sets of investors, one being noise traders and another set of investors being smart money investors.

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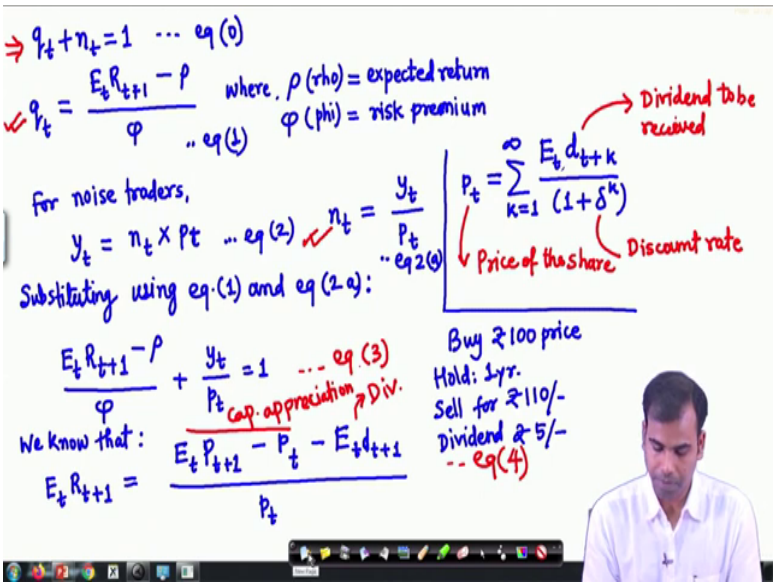

So, going by the argument given by Shiller if we represent them as q t and n t it should be expressed as q t plus n t is equal to 1 because of the market clearing argument where supply equals demand we can say that if demand from smart money investor that is q t can be expressed as expectation of the return for a smart money investors minus the expectation of return represented as rho divided by let us say phi which is basically the risk premium.

So, if I can explain the notations here where rho basically represents the expected return and phi basically represent the risk premium for the equity income. Now, if we can denote this particular equation as equation 1 and we know that for noise traders the demand can be explained as n t which is the percentage of demand of stocks by the noise traders we know that the total value of a stock demanded by noise traders could be a function of the demand for stocks which is the number of stocks or percentage of stocks into the price demanded at time t.

So, this particular equation can be expressed as equation 2, if we rewrite this. So, demand for stocks by noise traders could be written as total value of the demand by the noise traders divided by price by price of the stock that they are demanding. So, if we can go back the argument we understood in the very beginning of this course that price of any financial securities is basically nothing, but the present value of all future cash flows and when we talk about cash flows associated with financial securities such as stocks it could be the present value of all future dividends.

So, if we can denote this in terms of price of a financial security at time t it could be the expected dividend the expected dividend at time t divided by 1 plus let us say delta for k if the time period considered here is k and this being summed for total time period that we are considering here till infinite period. So, we are considering here in finite period because when we start investing in a company's equity which is basically share of a company we assume that the company is going to be there forever and we are going to get the dividend from that company's investment for forever.

And, that is why we consider this pricing model which is basically also known in finance theory as the dividend discount model as p t is a is equal to the sum total of all dividends receipt to be received in future divided by 1 plus delta here which is basically the discount rate. So, if I can give further explanation this delta is the discount rate and this d is dividend to be received in dividend to be received in future and this P of course, is price of the share.

So, we understand so far that according to Shiller's argument total demand would be equal to 1 that is 100 percent and demand by noise traders can be expressed as n t is equal to y t which is basically the total value of the shares being demanded divided by p t which is the price of the share and demand by the smart money investors can be expressed as q t which is a function of return expected and the risk premium that they are seeking in terms of equity investment.

Now, if we go back to the argument to this particular equation let us say this equation being equation 0. So, if we try to substitute so, let us say if we substitute using equation 1 and equation 2 a. So, I am giving this particular equation as named equation 2 a, if we substitute these 2 equations basically this equation and this equation in this particular equation we get expectation of return at time t plus 1 minus rho divided by phi this plus y t by p t is equal to 1. So, this is just the substitution of the term q t and n t in the market clearing argument modeled by the Shiller's framework.

Now, if we try to extend this argument and rewrite this particular function. So, let us assume let us call this particular equation as equation 4 or rather this should be equation 3. We know that return of any asset if we can say we know return of any asset that is expectation of return at time t plus 1 is return on capital appreciation which is basically difference in price and the dividend expectation divided by the price at which we have purchased. So, just to explain this particular function this is let us call this equation 4.

So, in equation 4 when we define return expectation of an investor as the capital appreciation and the dividend income. So, we have already discussed in one of the previous sessions that when you invest in a share of a company you expect some dividend during the holding period and at the same time you also expect that if you are going to sell that share in future you get some capital appreciation. So, return on any share investment is basically comprising of two parts, one is dividend income and another is capital appreciation.

So, capital appreciation is basically the growth in value of the stock from the price at which it is purchased and dividend income is any intermediary income that you have received in terms

of dividend. So, if I can say this through a simple example if you have invested in a company and let us say purchase at 100 rupees and you hold it for let us say 1 year, after 1 year you sell this stock for let us say 110 rupees and in the meantime you have received a dividend of 5 rupees.

So, your total income from this investment would be 110 minus 100 which is basically sale price minus buy price that is rupees 10 and dividend income of 5 rupee. So, this particular equation 4 explains the same phenomena, where you get dividend income denoted as d this is your dividend income and this is your capital appreciation in terms of in this example 110 from 100. So, these two components of any in any share investment can be considered as the explanation for return expected on that particular investment.

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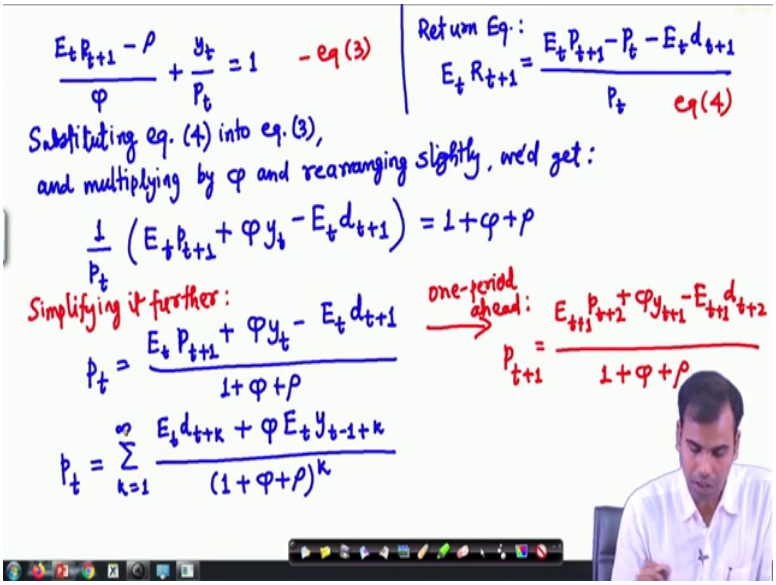

Now, if we extend the same argument further we have seen that the final equation that we have is basically expectation of return which is basically price a return at t 1 minus rho divided by phi plus y t minus p t is equal to 1, we had named this particular equation as equation 3. We had also seen that the return equation is expectation of return at time t plus 1 is equal to expectation of price t plus 1 minus price t, expectation of dividend divided by price t, this is named as equation 4.

If we substitute again equation 4 into equation 3 and let us say multiply to simplify this multiplying by phi and rearranging slightly we would get the following expression. So, if we have equation 4 and we know that return can be expressed in terms of equation 3 and we substitute equation 3 into equation 4, we will get the following value which is expressed as expectation of price plus phi which is basically the risk premium and y t which is basically the value of a demand demanded share and then expectation of dividend at time t plus 1 is equal to 1 plus phi plus rho.

If we simplify further we get price formula which is p t is expectation of t p t plus 1 plus phi y t minus E t d t plus 1 divided by 1 plus phi plus rho. Now, we know that one period ahead if we take it further to one period ahead this should look something like this. So, price at time t plus 1 will be expectation t plus 1 price t plus 2 plus phi y t plus 1 minus expectation t plus 1 d t plus 2 divided by 1 plus phi plus rho.

If we use recursive substitution which is basically we repeat it many times we will be getting a function which can be expressed as price t as a function of total sum of expectation of dividend for k period model plus phi expectation of the value that is demanded by all investors in 1 minus k 1 plus k period divided by 1 plus phi plus rho for k period where k is 1 and this is an infinite period model. So, if we substitute this repeatedly and we do this as a recursive substitution framework we will get this particular function.

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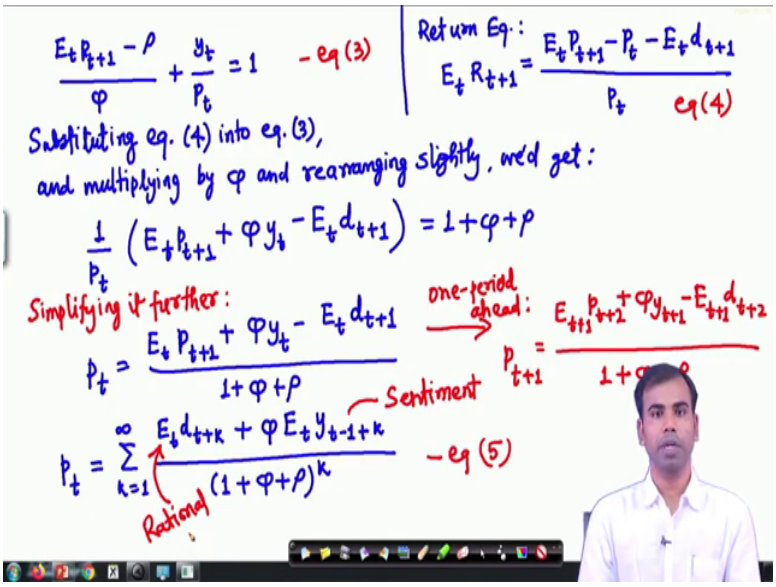

Here if you could see this here if you could look at the final function that we have final expression in terms of equation 5, this equation has two major components one dividend and another is the valuation value of shares demanded by the noise traders. Now, for a rational investor it is very important to forecast not only the dividend that is based on fundamental value of shares, but also the demand expected by the noise traders. And, that is how forecasting of price for rational investors would become more difficult unless they are very good in it is calculating or forecasting the value of dividend as well as the sentiment.

So, this particular component can be known as sentiment which is basically a rational expectation and this particular component is a rational expectation. So, for a investors who are rational and who are smart monetary investors for them it becomes more important to

understand how irrational investors are behaving in the market, because that is how they can arrive at a reasonable price at the end of the day.

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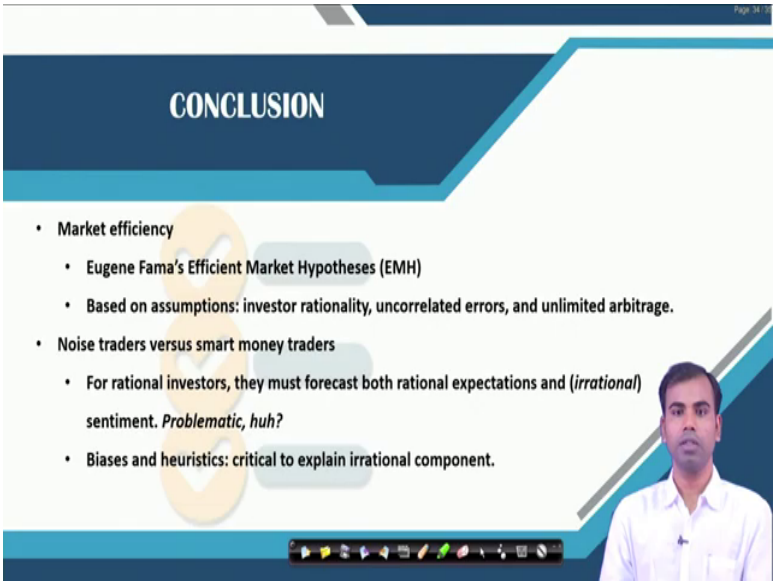

If we have understood this model given by Shiller which explains that price of a financial asset can be determined by forecasting the fundamental value of financial asset as well as the value deviations due to the noise traders expectation in terms of their sentiment or behavioral biases then only they we can arrive at the right valuation of a financial security.

Now, for this session we have discussed the problems or the issues associated with market efficiency hypothesis given by Eugene Fama and we can all we have also seen that the assumptions which based on which a efficient market hypothesis was evolved was not justified in the change scenario. And, because of which when noise traders start behaving

irrationally the fundamental value of the shares are dependent on not only the dividend, but also on the sentiment of investors, that is all for now.

Thank you very much.