Quantitative Finance

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Module – 07

Lecture – 40

Welcome back, so let us continue our discussion, our session about credit models.

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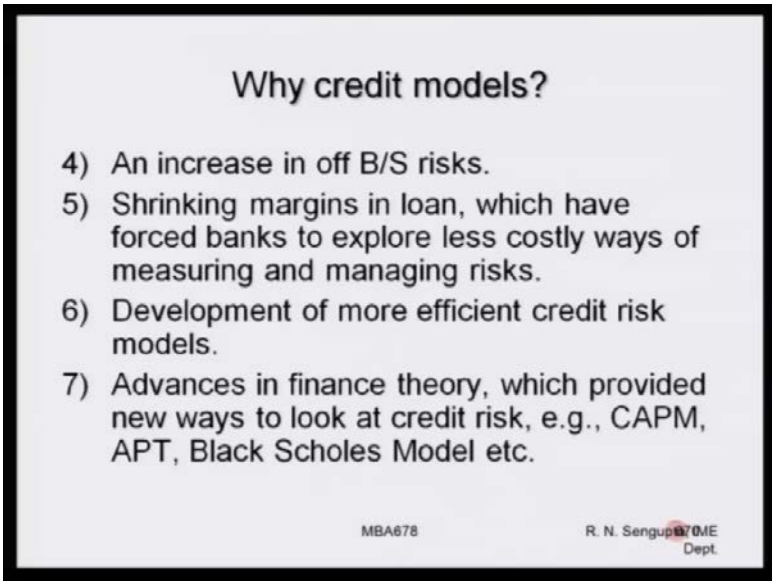

So, why credit models? So, the fourth point is an increasing the half balance sheet risk. So, you have different type of risk corresponding to whether loan has been taken and higher interested, lower interested, whether you are trying to run a business. For a sector, which is under in the zone, where this huge amount of competition or whether it is less competition, whether there are number of prices has increases over the number of pays are decrease, whether the market shares increase, decrease. So, all these things would basically be given in some way in the profit and loss and definitely in the balance sheet account.

Shrinking margins in loan, which have forced banks to explore less costly ways of trying to give the loan. So; obviously, as there are different type of banks, different type of financial institutions, different of lending agencies who are willing to learn and they are willing to learn for different type of sectors also. So, the companies are trying to bargain,

where they are able to get a loan and a much more competitive rates.

Development of more efficient credit risk models has come in to the market, where the financial fundamentals, the mathematical models are able to take care in a much better fashions; such that they are able to give a much more clearer picture about how the companies doing. Advances in general financial theories, which provide in general a good over view or good understanding of CAPM model, APT model, Black Scholes models and so on and so forth are down been considered in order to analyze the credit models in a much better way.

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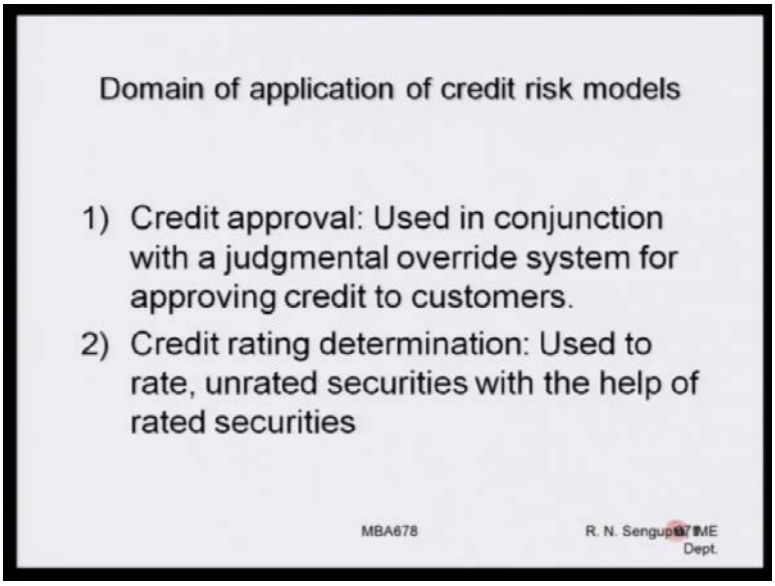

Domain of applications of credit risk models are generally in the credit approval; that is used in conjunction with a judgmental to override system for approving credit to customers or whether credit is actually applicable to be given, whether credit should be enhanced, credit should be reduce, what is the overall risk of the credit, whether the company is now facing a huge amount of risk and subsequently the credit rating should be decreased or vice versa. So, those are the actual domain of our application.

Credit rating determination is used to basically rate unrated securities and unrated different type of financially ventures. So, if you want to go into a business, which has not been yet and has being analyzed by any count different type of financial institution or if you whether, you as a company are going into the sector for the first time, then; obviously, your 40 is there. Say for example, in manufacturing sector or is there in service sector or is there in steal sector or is there in automobile sector, but you want to

venture in some different areas.

So; obviously, that is a new venture and the overall risk perception, which the banks thinks with respect of you, you means an organization is trying to go in to the business is totally different in this new sector, then with respect to in the whole sector, where you are operating. So, those have to be analyzed and those under these securities, which we are trying to float they would be analyzed. So, this is also a domain of application for the credit models.

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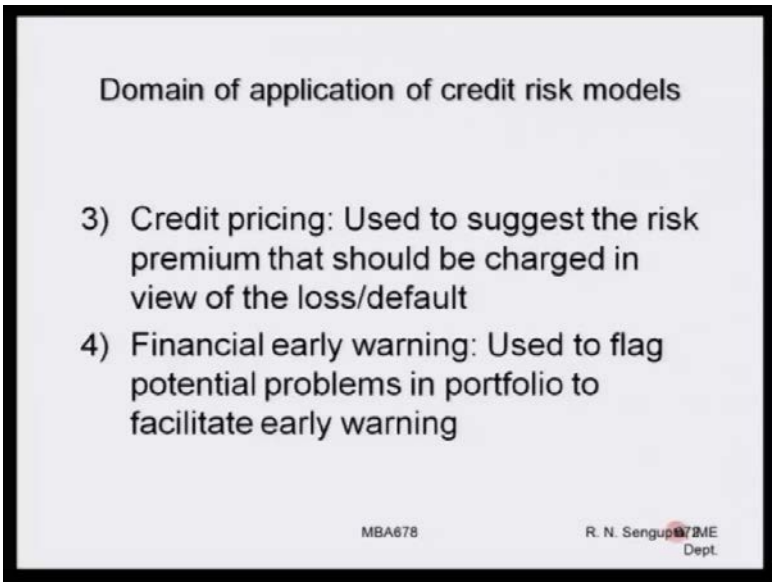

Credit pricing is important and; that is one of the another domain applications used to suggest the risk premium, that should be charged in view of the loss and default. So, if you have been defaulting if the overall risk is higher, whether the overall risk is low or whether the competition is high and low, then; obviously, the credit rating agency, the banks, the people who are willing to give the loan would try to analyze the problem in a new perspective and see, what is the overall risk enhanced risk, lower risk, which they would be facing, with the lenders would be facing, with the banks would be facing, with the investors would be facing, considering the companies willing to go venture in to that area.

Financial early warning, so; obviously, if you do a good, use good models and you try to basically evaluate the performance on the company on a regular basis, then if there is a default of risk or if the overall risk perception is increasing in the market or whether the companies doing bad or whether the market share is shrinking or whether the number of

phase is increasing. Obviously, all these information's are in a way given in the credit model; such that some early morning, the systems can be made into place; such that people can take care of that in a rational manner.

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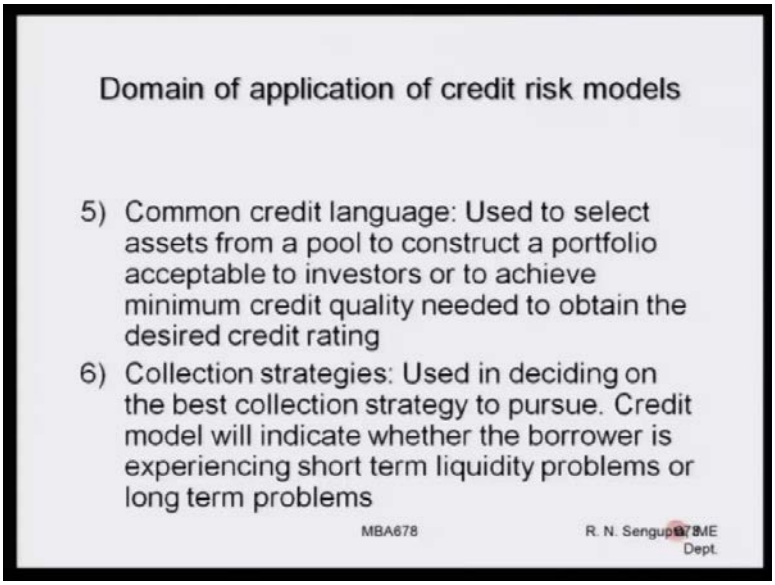

So, for an application of credit models, the common credit language would be same. So, what standard and poor's would do and based on, which it will give the rating of a company as double A or double B plus should be the same way in which Moody's would do and give the same type of rating.

So, if the set of information or set of variables or set of parameters based on which you as a company are trying to analyze a person or an organization which is ask for a loan, should not differ the analysis, the output result should not differ from the one with some other person, where the same set of knowledge is trying to analyze; that means, there should be some parity in the way the things are analyze.

Collection strategies, so this I mean… If your default risk is increasing or your default risk is decreasing, so; obviously, that should give you some warning signals, that whether the collateral should be increased, should be decreased or whether the overall quality of the quadrilateral should be change, point number 1. Point number 2, if your level of default is increasing; obviously, it sends a warning signal to the people you have lend the money, that their money should be collected much more before, then actually it is period of collection is or say for example, there should be a third party, which is willing to take the risk.

So, if you initially trying to utilize the credit model in order to understand the credit rating concept of a particular company and if say for example, the company has taken a loan and if the credit rating is very high or very low then; obviously, the concept of having a third party in order to ((Refer Time: 06:22)) the overall risk perception, which the company who is lending the money should be taken into account, in such a way that the credit rating models gives that picture or gives that early morning signal much beforehand.

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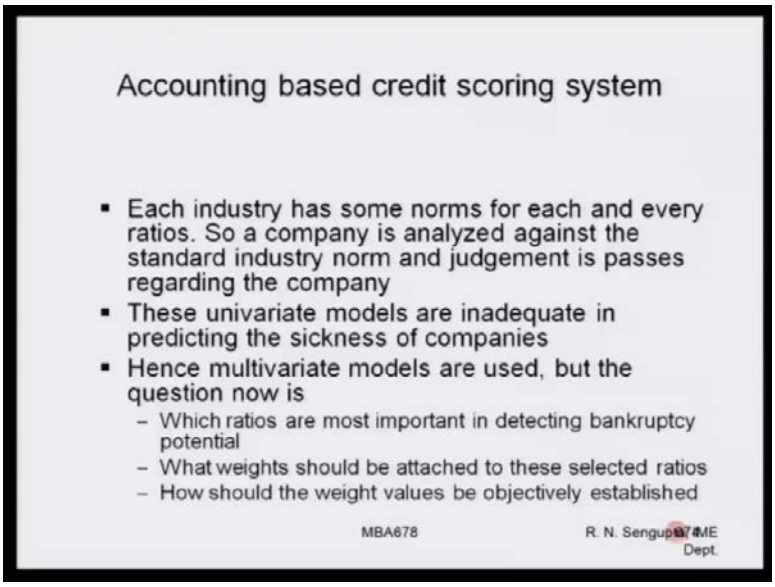

So, accounting based, principle based or accounting concept based credit rating scores, each industry has some norms for each and every ratios, all the financial issues which you are consider. So, companies analyze again the standard industry perception. These univariate models… Why univariate? Because, you consider only one variable or one parameter for study, these univariate models are inadequate in a predicting the sickness of the company.

Hence multivariate models are generally used, where we try to combine the interrelationship effect, which is happening between these default ratios. What effect does the financial issue have on the different type of market share? What is the leverage ratio, what does the collection period, whether they have effect on the overall credit rating concept, what is the correlation coefficient existing between this variable, that should also be taken into account in a very rational manners; such that the overall picture which you are getting is much better than considering them on a standard alone basis.

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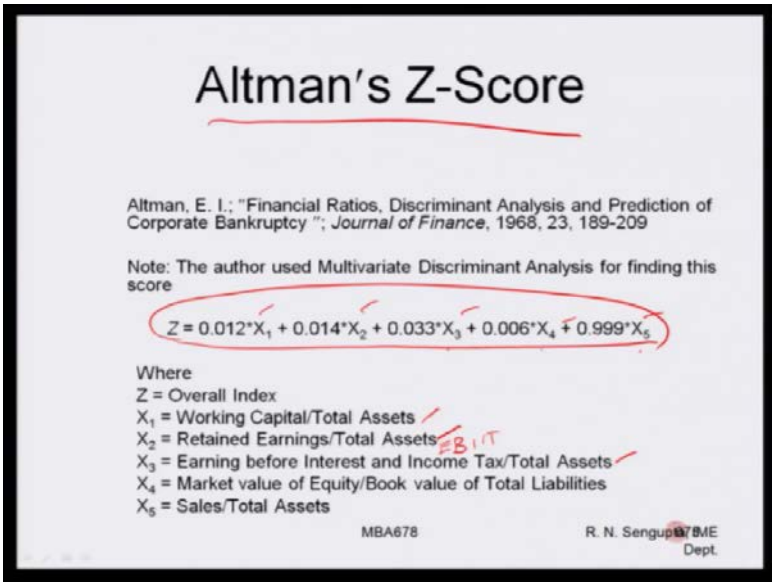

So, we will consider 5 or 6 different ratios, so the first person who had consider this was Altman, so that is known as the Altman Z score. So, Altman basically came out with this study in the journal of finance in the 1968. So, he use Multivariate Discriminant Analysis for finding this score. So, this score is depending on what type of sector which you are studied is given by the simple equation, is this one.

So, X 1 is basically the working capital to total assets, which will be considered from the balance sheet, profit and loss account and the trial balance. X 2 is the retained earnings by total asset, earning before interested an income tax, EBIT. This is the retained earnings before interest and income tax by total assets. Market value equity by book value of total liabilities and sales by total assets are respectively X 3, X 4, and X 5.

So, once you plug in all these values with these ratios with, I am taking this a constant has given 0.012, 0.014, 0.033, 0.006, 0.999. So, what are these values in a very simple manner? Consider, that if X 2, X 3, X 4, X 5 are all constant not changing with respect to time, then and if X 1 is changing, then the rate of change of X 1, it is effect on Z, which is basically the overall index or the Altman Z score has an effect of 0.012 unit. Similarly, if X 1, X 3, X 4, X 5 are constant, then the effect of X 2 is be at a rate of 0.014 and so on and so forth. For X 3, which is 0.033, for X 4 it is 0.006 and for X 5 it is 0.999, so this is the Altman score.

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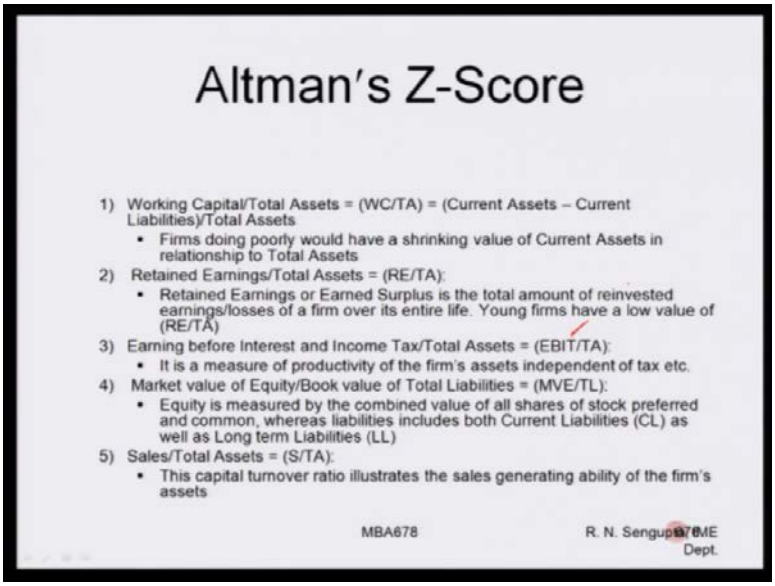

So, if you go into the details of the Altman Z score and study the overall analysis, it gives you for the first one the working capital to the total assets. If firms are doing poorly, firms doing poorly would have a shrinking value of current asset in the relation to the total assets. Hence, it would have a effect on the overall Z score. Say for example, for the second one, retain earning to total assets. If the total retain or earning earned surplus is the total amount of the investment earning or losses of a firm over entire time. Young firms of a lower value of retain earning to total assets, retaining the amount of money which is being retained in the firm.

Earnings before interest, income tax by total assets, which is EBIT. It is the measure of the productivity of the firm's asset independence of tax. So, higher the value of often complex after interested, which is been paid if the value is very high; obviously, it means retain the company has been able to retain a whole amount of money in it is covers to run it is business or give, convert that into say for example, for investment in R and D account as an investment necessarily.

Market value of equity to book value of total assets is, it is equity is measured by the combined value of all assets of stocks preferred and common whereas, liabilities includ both current accounts and long term liabilities. And finally, sales to as total assets this capital turn over issue, which is known as the competitive turn over issue illustrates the sale generating ability of the firm's asset.

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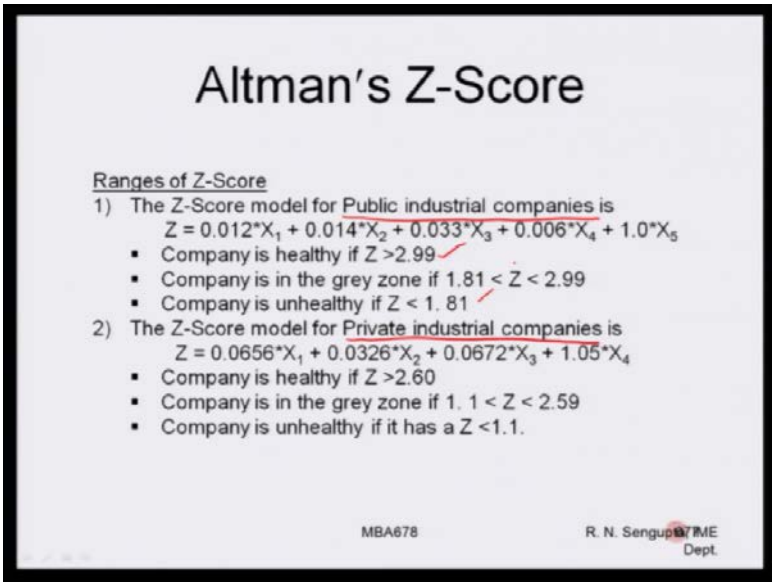

Now, if you do going in to the details, what does the say Z score imply, these are they like this. If it is a public industrial company in US in the 1960's as in the study has been done or earlier 1950's and if you have a set of companies which is the private industrial companies, then score of the first case, if Z is greater than 2.9, Z is between 1.81 to 2.9 and less than 1.81, then the company respectively can be categorized as healthy, as in the grey region with this not healthy not poor and in the unhealthy region.

So, depending on the Z score you can definitely quantify that. If it is a private industrial company, the corresponding values for a healthy company, grey company and unhealthy company are respectively. If Z is greater than 2.60, if say grey Z is between 1.1 to 2.59, which is or 2.60 and companies unhealthy if it is less than1.1.

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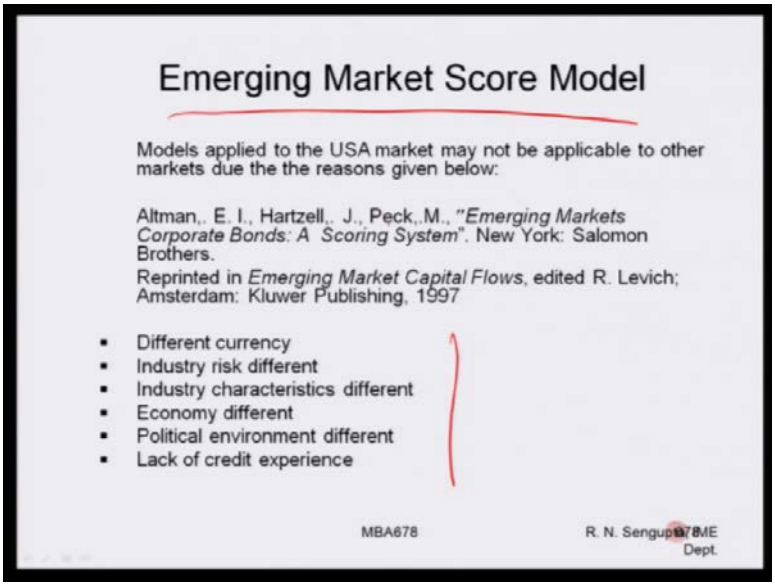

So, later on Altman also work on different models other Altman called models are emerging market score models it came out in the 1997 and the different ratios, which for which considered, which was much more than the Altman first Z score or different currencies. So, if we are trying to analyze a company, which is a transnational company multinational company, then; obviously, operation how the companies doing in different countries, what is the currency risk and all this should be taken into our account.

So, different currencies interested risk industrial risk different being in different in different countries industry characteristics being different economy may be different political environment and lack of credit experience all these things in a quantitative when quantity features, where considered by emerging market score, which was proposed by Altman and is to authors and this is also a much more better model than Altman and Z score.

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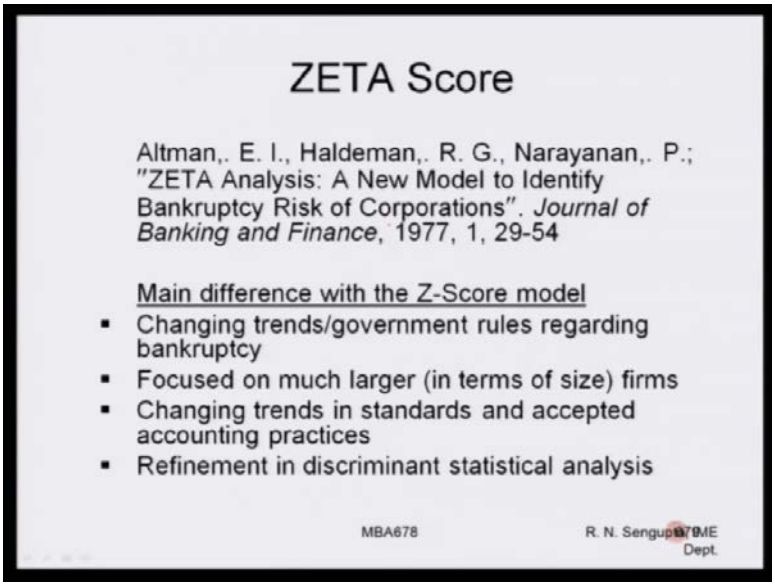

Then, you had the ZETA score model again propose by Altman, so that also came out in 1977 the main difference of this theta model with respect to the Z score R changing trend in government rules and regarding bankruptcy rules are consider in the ZETA score not in the X score it focused on much larger in terms of size of company. So, size of the company and the size of the form was also considering in a very, very nice way in this ZETA firms model.

Changing trends and standards and excepted accounting principles are also considered the ZETA score and refinement in the discriminant analysis techniques statistical techniques, what you utilize in the ZETA score rather than in the Z score model for Altman.

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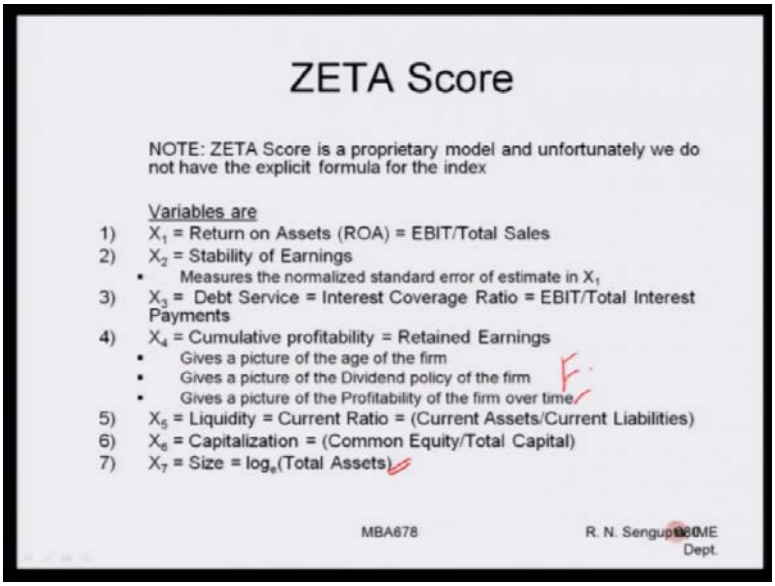

Now, in the ZETA score the variables used or X 1, which is the return to asset, which is EBIT total sales X 2 is stability of warnings X 3, Z interest XY is cumulative profitability X 5 is liquidity X is a capitalization X of the science. So, this is size concept, which is be broad into this score, which was not there in the Altman Z score model. So, these in details, what this, what does, what is the effect of X 2, what is the effect of X 4.

So, all these things are mentioned I am not going to into details you can check this science, but let me continue in trying to analyze other models, which are also there in the industrial.

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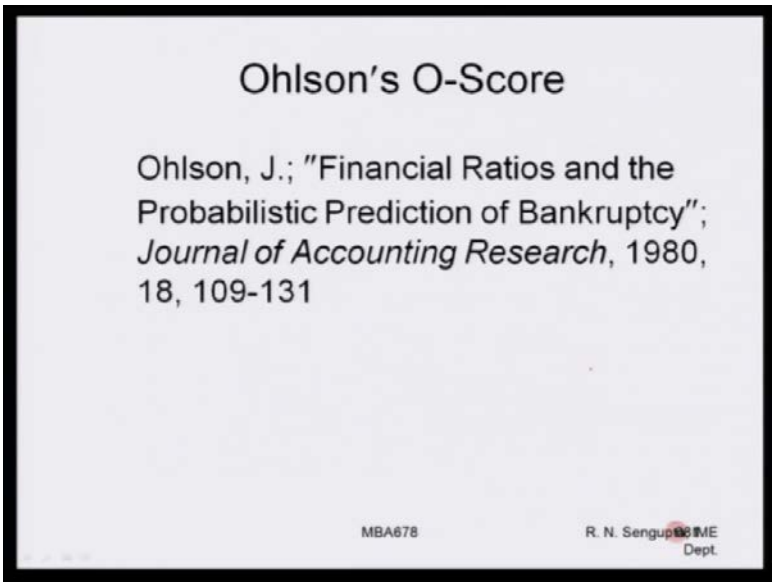

Earn the Ohlson's O score it came out in 1990 this is the financial ratios and probabilistic prediction of bankruptcy, where the use for the first time concept of probability to find out, what is the range of scores between each a company can be mentioned as a bankrupt or non-bankrupt.

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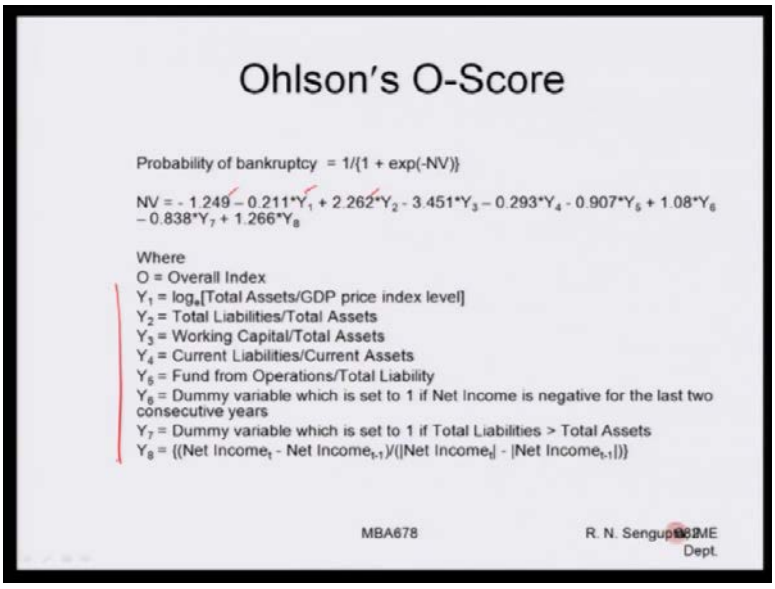

So, this probability of failure of, which according to Ohlson's score is given by one by one plus exponential minus NV, n p is basically the net value of the company. So, where the different ratios, which you see Y 1, Y 2, Y 3, Y 4,Y 5, Y 6, Y 7, Y 8 and depending on all the variables or fix values, which r the Y 1 to Y 8 or has given as log of total assets to GDP value total liability is to total asset work in capital by total assets and so and so forth till now.

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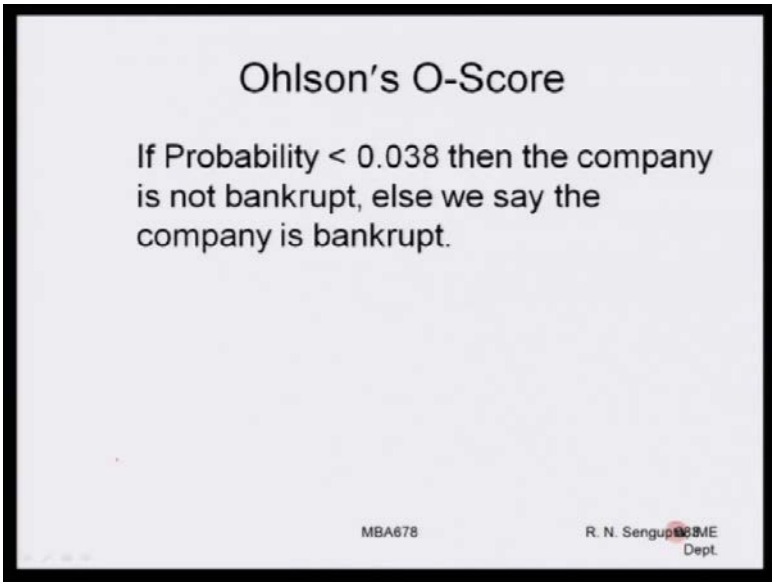

Now, according the Ohlson's score if probability is less than 0.03, then the companies may not bankrupt else we say the company is bankrupt; obviously, more refinement can be done in the also score to find out regions, where you can definite term some certain probability depending on the value has a company is definitely doing well. Then, the companies in the gray whether the companies in the bankrupt stage.

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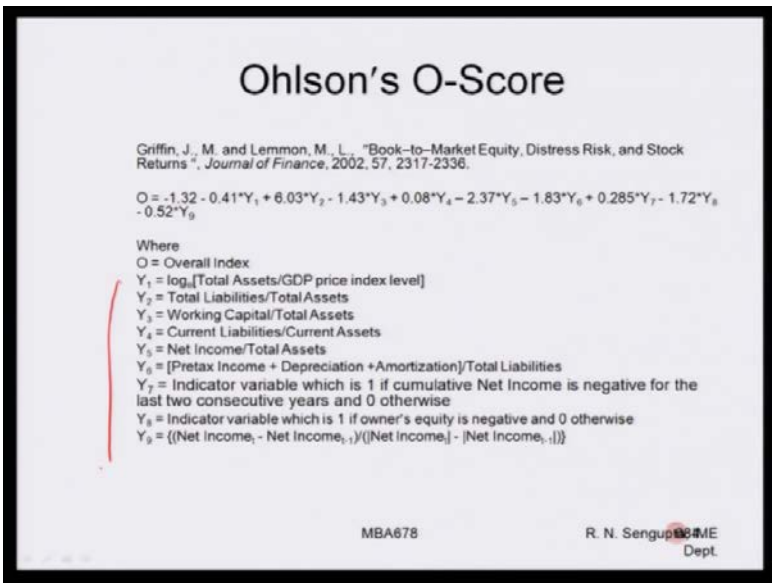

The Ohlson's score also is in another format by is given by Ohlson's and lemon again in the same type of also scores, where the value is also score and all the variables Y 1, Y 8 it is a Y 9 here it was Y if the they have the same implication and you can find out reading this slice or reading the journal paper, which is during here.

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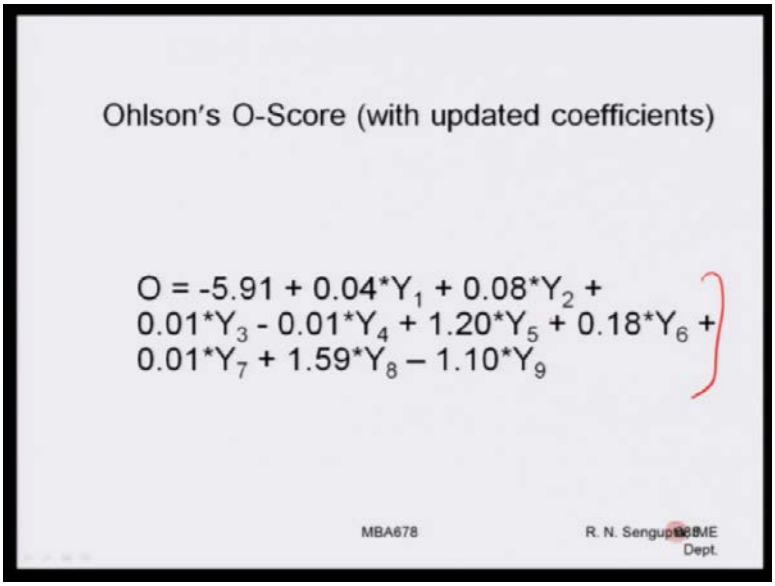

So, Ohlson's score with updated coefficient is given by this, this was found in one people later of working of Ohlson's after it was predict given for the first time. So, these again Y 1 to Y 2 the variables as discussed and the constants are given as minus 5.91, 0.04 and 0.08 or the corresponding. Rate of change of this Y 1 to Y 8 and 9 depending on the values are the constant this is the very simple definition, which I am trying to give you.

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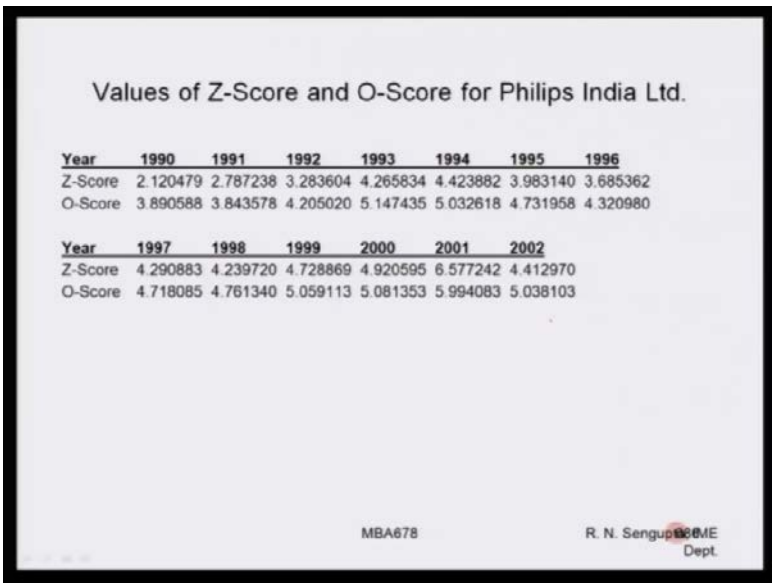

Now, we have used very simply even though in the data may be little bit old we have use the values of the Z score and the answer score for Philips India depending on all the ratios, which are there starting from 1990 to 2002. Obviously, it would have been better if we have what it has all for each year or if we had the results for the till 19, 2015, then

answer the overall scenario, which we could have given would have been much better, but the analysis, which you have done also assume good decent over view, how the company is doing and whether step should be taken by the credit creditors or steps should be taken by the company in order to basically tide in it bells; obviously, basically make a overall view they, where it is going on.

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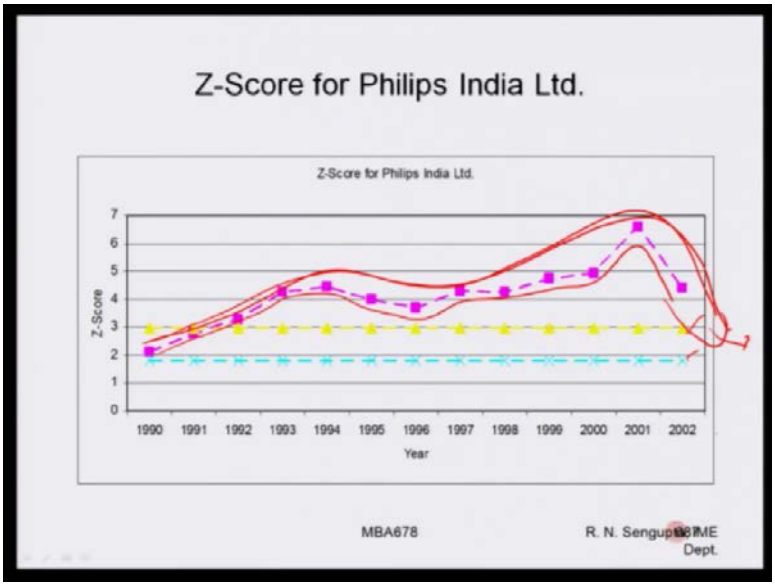

So, if I consider the scores this one the pink the blue one and the yellow one I basically the, so let me see. So, this Z score is basically the all the ZETA score the Z score and the emerging market values, which are given for Philips from the 1990's to the 2002 if you see the values. So, if I think, where this is basically the trend of the Z score this is nothing to do with Z score of emerging markets score these are the threshold value, which have taken depending on whether it is a bankrupt or non-bankrupt one.

So, you see in this channel in 1990's to 91 it was not going well, then it start as increasing and if you see the trend this is a short fall. So, if continuing doing all would I am this is of 2002, 2003, 2004, 2005, 2006; obviously, that will give as a better answer. Now, only thing is notice this, this trend this is by the Z score model for Philips. So, let us now, switch 1000 score.

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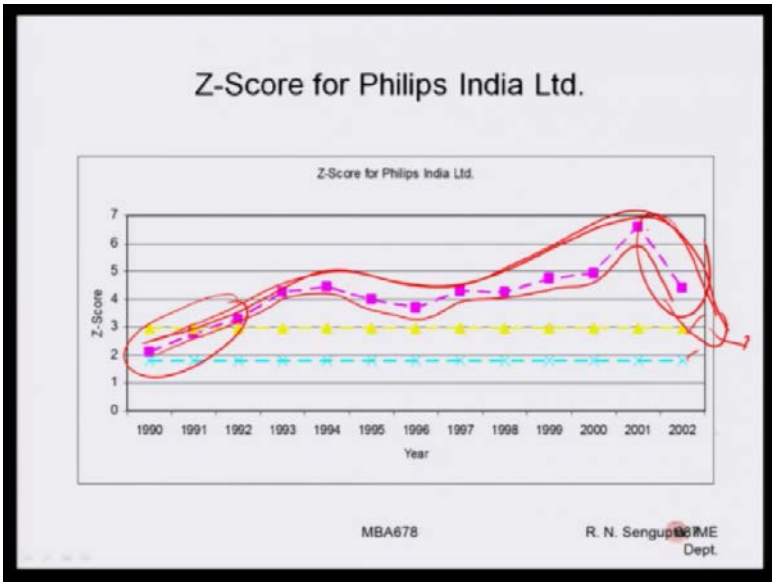

Again, if you see the trend look me more play attention that the trend, this trend and the last one we, which we got using the Z score almost the same. So, which means in the models are specific to the internal set of information nothing to do with the models. So, if we have build up model, which takes care of all these variable in a very scientific manner in a rational manner, then the results of two different models would also give you the same type of analysis.

So, this the type of analysis, which may in for from using the Z score for a Philips on to 1990 to 2002. And then, using the also score for again from 1990 to 2002 almost the same it means the initial two years it was definite not good, then it starting increase and in the last year again there was a depth in the trend, which is exactly, what you are getting in both the graphs and we are trying to analysis the Z score and the also score.

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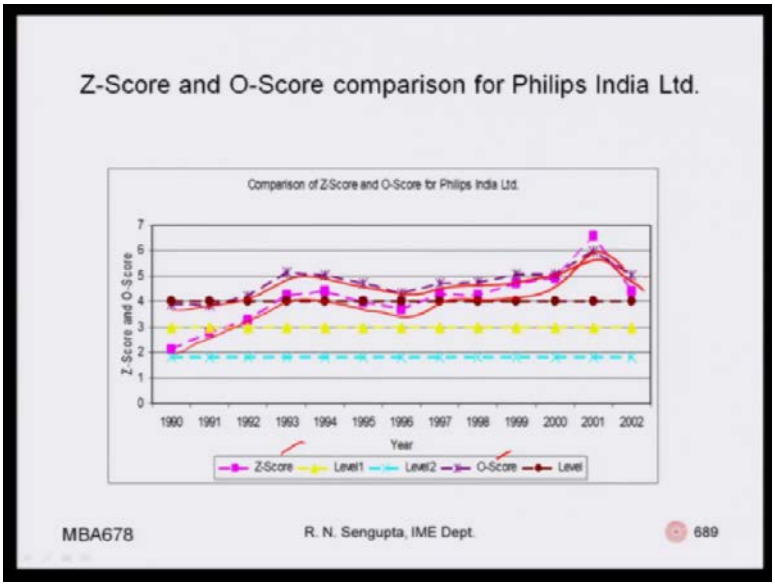

When I combine them, so depending on the levels you have basically the pink one is the Z score and the this violet light violet one is basically for the old score and all the score should these are the trends, which you see this is the one for Z 1 and this is the one for the option score. So, if we see this almost their basically for in parallel to each other so; obviously, the overall analysis, which you can derive from both of them are in term exactly the same. The fundamental concept, which you will be getting from both the model, you would be exactly the set.

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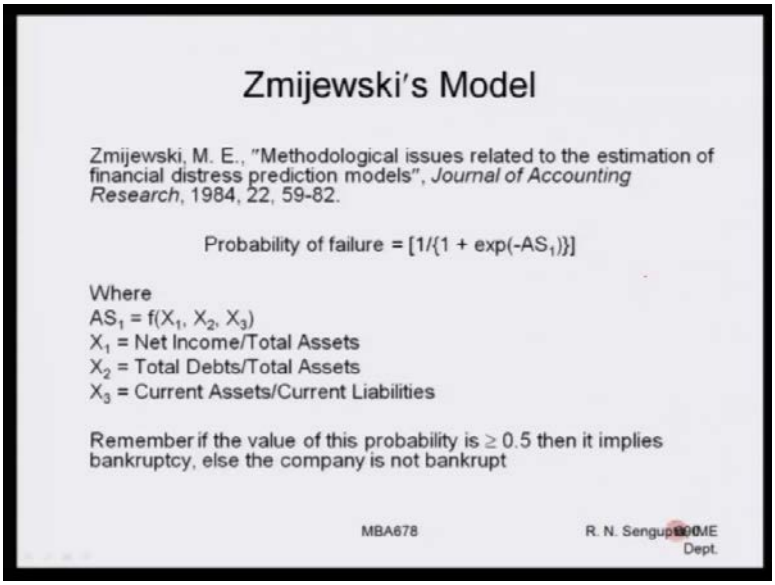

Then, you have the Zmijewski's score it was given in 1984 and came out in general accounting again we have to basically have the concept of probability the probability at

the failure this inverses score is given by the variables of the study are X 1, X 2, X3, which is given by net income by total assets total debts by total assets and X 3 basically the current assets by total liabilities. So, remember if the probabilities of failure is greater than point five, then in implies bankruptcy else the company is not failed so; obviously, and this is can be done for all this modules take in separately.

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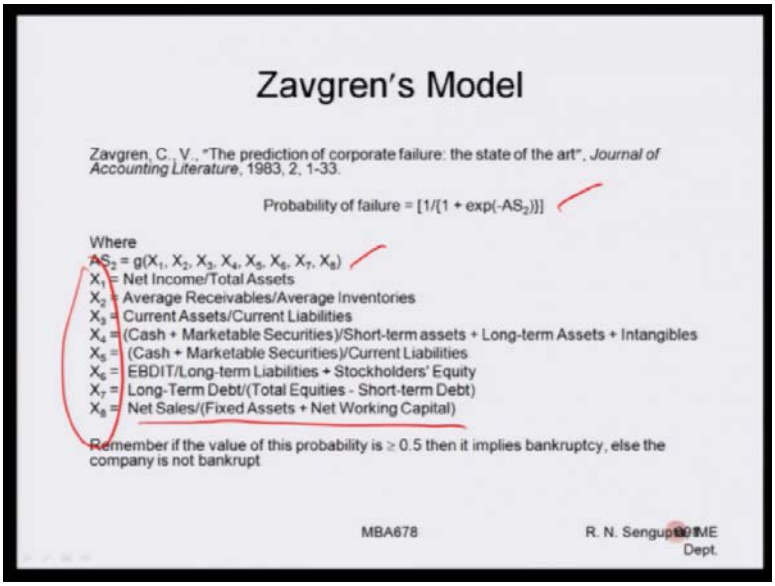

To wrap it up we will just considered the lost one, which is the Zavgren's score, which came out in again in 1983 there are other models also, but I am only discussing the important one again in gives you in a probability aspect, what is the ratio and based on the ratio, what is the probability of failures. So, again if you see basically exponential time 1 plus 1 by exponential to the power minus AS 2, which is the Zavgren model and this gives an models considers the variable, which is from X 1 to exit, which are net income to total sense and the last one means net sense which is fixed assets per, what capital networking capital.

So, again we have with the probability is greater than 0.5 it is basically a bankruptcy less it is not, so with this, so I will and end a discussion for the different type of credit models in a very simple manner and then, continuing with in other discussion work models, how they can be analyze in a much better way.

But, these models are not that I am trying to give you end analyzes of this things just to give you the interest, that these models are existing in the market and you definitely if you do a thorough analysis using the different fundamental principles of the company

using the balance sheet, profit and loss account and some good mathematical techniques, statistical techniques you can find a lot of information and try to analyze a company in a very rational manner. With this I will end the class.

Thank you very much.