

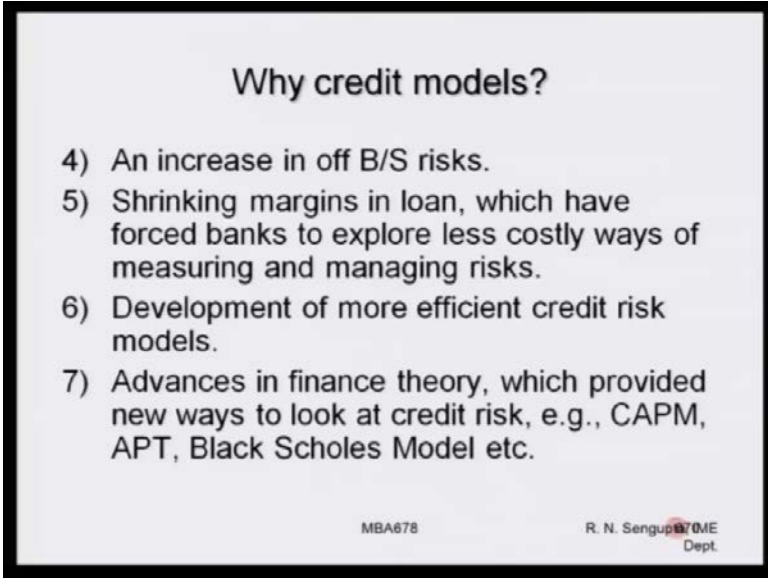
Quantitative Finance
Prof. Raghu Nandan Sengupta
Department of Industrial and Management Engineering
Indian Institute of Technology, Kanpur

Module – 07

Lecture – 40

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

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Why credit models?

- 4) An increase in off B/S risks.
- 5) Shrinking margins in loan, which have forced banks to explore less costly ways of measuring and managing risks.
- 6) Development of more efficient credit risk models.
- 7) Advances in finance theory, which provided new ways to look at credit risk, e.g., CAPM, APT, Black Scholes Model etc.

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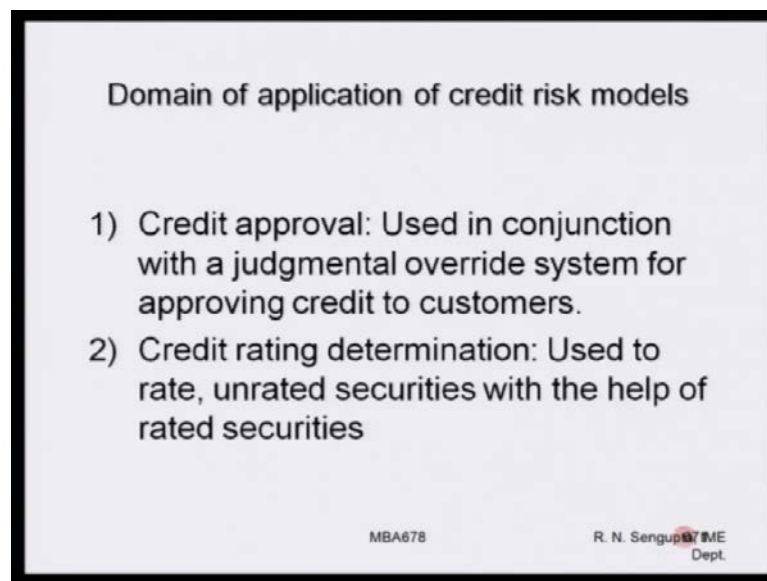
So, why credit models? So, the fourth point is an increasing the half balance sheet risk. So, you have different type of risk corresponding to whether loan has been taken and higher interested, lower interested, whether you are trying to run a business. For a sector, which is under in the zone, where 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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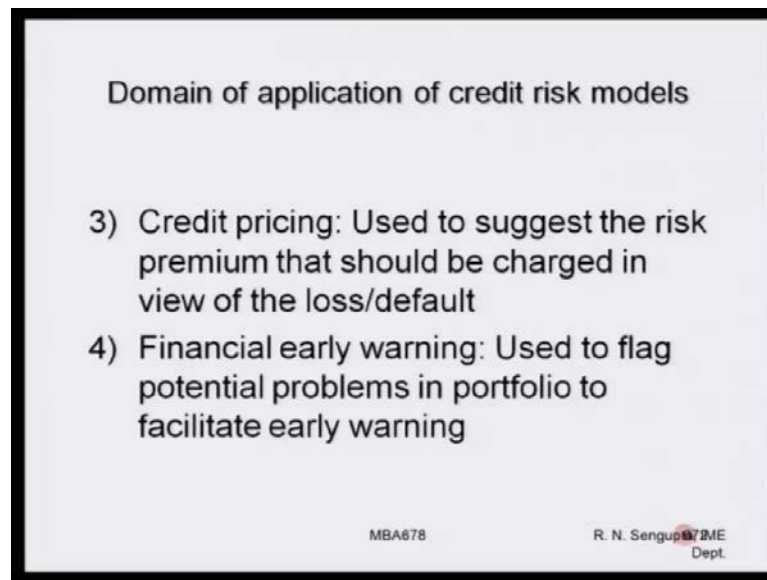
Domain of applications of credit risk models are generally in the credit approval; that is used in conjunction with a judgmental to override system for approving credit to customers or whether credit is actually applicable to be given, whether credit should be enhanced, credit should be reduce, what 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 think 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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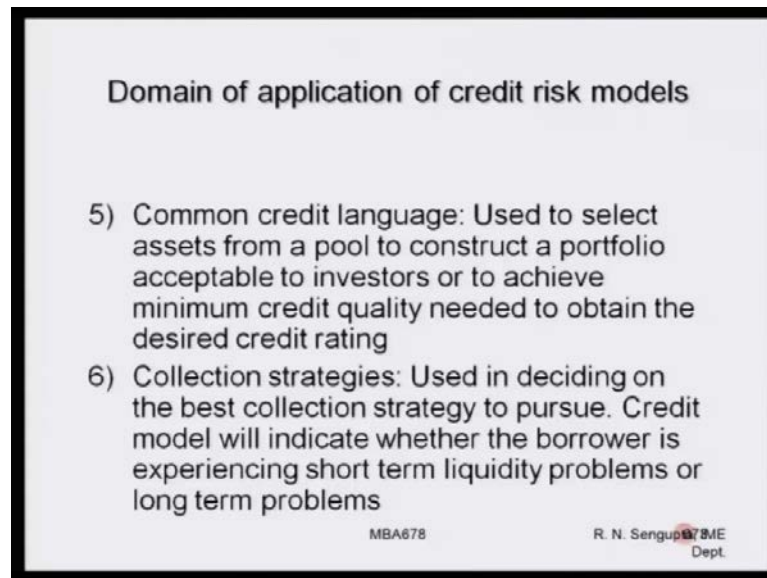


Credit pricing is important and; that is one of the another domain applications used to suggest the risk premium, that should be charged in view of the loss and default. So, if you have been defaulting if the overall risk is higher, whether the overall risk is low or whether the competition is high and 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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Accounting based credit scoring system

- Each industry has some norms for each and every ratios. So a company is analyzed against the standard industry norm and judgement is passes regarding the company
- These univariate models are inadequate in predicting the sickness of companies
- Hence multivariate models are used, but the question now is
 - Which ratios are most important in detecting bankruptcy potential
 - What weights should be attached to these selected ratios
 - How should the weight values be objectively established

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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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Altman's Z-Score

Altman, E. I.: "Financial Ratios, Discriminant Analysis and Prediction of Corporate Bankruptcy"; *Journal of Finance*, 1968, 23, 189-209

Note: The author used Multivariate Discriminant Analysis for finding this score

$$Z = 0.012 \cdot X_1 + 0.014 \cdot X_2 + 0.033 \cdot X_3 + 0.006 \cdot X_4 + 0.999 \cdot X_5$$

Where

Z = Overall Index

X_1 = Working Capital/Total Assets

X_2 = Retained Earnings/Total Assets EBIT

X_3 = Earning before Interest and Income Tax/Total Assets

X_4 = Market value of Equity/Book value of Total Liabilities

X_5 = Sales/Total Assets

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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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Altman's Z-Score

- 1) Working Capital/Total Assets = $(WC/TA) = (Current\ Assets - Current\ Liabilities)/Total\ Assets$
 - Firms doing poorly would have a shrinking value of Current Assets in relationship to Total Assets
- 2) Retained Earnings/Total Assets = (RE/TA) :
 - Retained Earnings or Earned Surplus is the total amount of reinvested earnings/losses of a firm over its entire life. Young firms have a low value of (RE/TA)
- 3) Earning before Interest and Income Tax/Total Assets = $(EBIT/TA)$:
 - It is a measure of productivity of the firm's assets independent of tax etc.
- 4) Market value of Equity/Book value of Total Liabilities = (MVE/TL) :
 - Equity is measured by the combined value of all shares of stock preferred and common, whereas liabilities includes both Current Liabilities (CL) as well as Long term Liabilities (LL)
- 5) Sales/Total Assets = (S/TA) :
 - This capital turnover ratio illustrates the sales generating ability of the firm's assets

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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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Altman's Z-Score

Ranges of Z-Score

- 1) The Z-Score model for Public industrial companies is
$$Z = 0.012X_1 + 0.014X_2 + 0.033X_3 + 0.006X_4 + 1.0X_5$$
 - Company is healthy if $Z > 2.99$
 - Company is in the grey zone if $1.81 < Z < 2.99$
 - Company is unhealthy if $Z < 1.81$
- 2) The Z-Score model for Private industrial companies is
$$Z = 0.0656X_1 + 0.0326X_2 + 0.0672X_3 + 1.05X_4$$
 - Company is healthy if $Z > 2.60$
 - Company is in the grey zone if $1.1 < Z < 2.59$
 - Company is unhealthy if it has a $Z < 1.1$.

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Now, if you go in to the details, what does the 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 than 1.1.

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Emerging Market Score Model

Models applied to the USA market may not be applicable to other markets due the the reasons given below:

Altman, E. I., Hartzell, J., Peck, M., "Emerging Markets Corporate Bonds: A Scoring System". New York: Salomon Brothers.
Reprinted in *Emerging Market Capital Flows*, edited R. Levich; Amsterdam: Kluwer Publishing, 1997

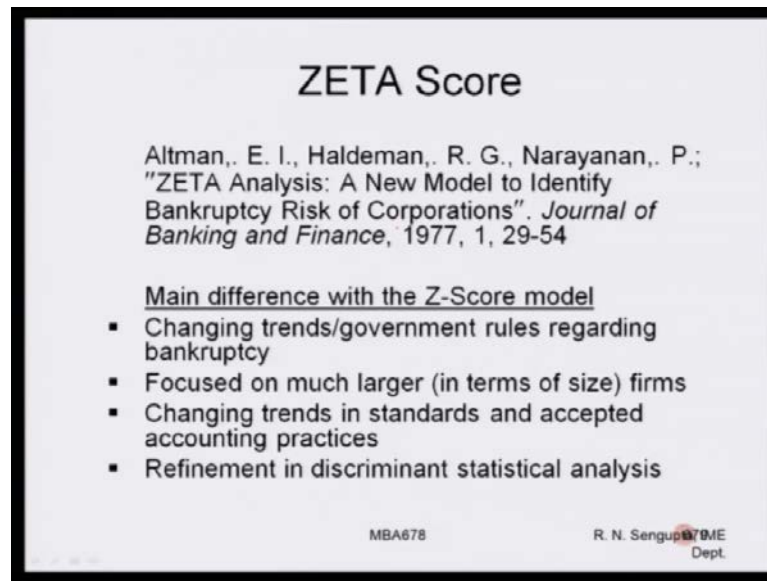
- Different currency
- Industry risk different
- Industry characteristics different
- Economy different
- Political environment different
- Lack of credit experience

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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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ZETA Score

Altman, E. I., Haldeman, R. G., Narayanan, P.;
"ZETA Analysis: A New Model to Identify
Bankruptcy Risk of Corporations". *Journal of
Banking and Finance*, 1977, 1, 29-54

Main difference with the Z-Score model

- Changing trends/government rules regarding bankruptcy
- Focused on much larger (in terms of size) firms
- Changing trends in standards and accepted accounting practices
- Refinement in discriminant statistical analysis

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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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ZETA Score

NOTE: ZETA Score is a proprietary model and unfortunately we do not have the explicit formula for the index

Variables are

- 1) X_1 = Return on Assets (ROA) = $\text{EBIT}/\text{Total Sales}$
- 2) X_2 = Stability of Earnings
 - Measures the normalized standard error of estimate in X_1
- 3) X_3 = Debt Service = Interest Coverage Ratio = $\text{EBIT}/\text{Total Interest Payments}$
- 4) X_4 = Cumulative profitability = Retained Earnings
 - Gives a picture of the age of the firm
 - Gives a picture of the Dividend policy of the firm
 - Gives a picture of the Profitability of the firm over time
- 5) X_5 = Liquidity = Current Ratio = $(\text{Current Assets}/\text{Current Liabilities})$
- 6) X_6 = Capitalization = $(\text{Common Equity}/\text{Total Capital})$
- 7) X_7 = Size = $\log_e(\text{Total Assets})$

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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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Ohlson's O-Score

Ohlson, J.; "Financial Ratios and the Probabilistic Prediction of Bankruptcy"; *Journal of Accounting Research*, 1980, 18, 109-131

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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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Ohlson's O-Score

Probability of bankruptcy = $1/(1 + \exp(-NV))$

$$NV = -1.249 - 0.211*Y_1 + 2.262*Y_2 - 3.451*Y_3 - 0.293*Y_4 - 0.907*Y_5 + 1.08*Y_6 - 0.838*Y_7 + 1.266*Y_8$$

Where

- O = Overall Index
- $Y_1 = \log_e[\text{Total Assets/GDP price index level}]$
- $Y_2 = \text{Total Liabilities/Total Assets}$
- $Y_3 = \text{Working Capital/Total Assets}$
- $Y_4 = \text{Current Liabilities/Current Assets}$
- $Y_5 = \text{Fund from Operations/Total Liability}$
- $Y_6 = \text{Dummy variable which is set to 1 if Net Income is negative for the last two consecutive years}$
- $Y_7 = \text{Dummy variable which is set to 1 if Total Liabilities} > \text{Total Assets}$
- $Y_8 = ((\text{Net Income}_t - \text{Net Income}_{t-1})/(|\text{Net Income}_t| - |\text{Net Income}_{t-1}|))$

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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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Ohlson's O-Score

If Probability < 0.038 then the company is not bankrupt, else we say the company is bankrupt.

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

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Ohlson's O-Score

Griffin, J. M. and Lemmon, M. L., "Book-to-Market Equity, Distress Risk, and Stock Returns", *Journal of Finance*, 2002, 57, 2317-2336.

$$O = -1.32 - 0.41*Y_1 + 6.03*Y_2 - 1.43*Y_3 + 0.08*Y_4 - 2.37*Y_5 - 1.83*Y_6 + 0.285*Y_7 - 1.72*Y_8 - 0.52*Y_9$$

Where

- O = Overall Index
- $Y_1 = \log_e[\text{Total Assets}/\text{GDP price index level}]$
- $Y_2 = \text{Total Liabilities}/\text{Total Assets}$
- $Y_3 = \text{Working Capital}/\text{Total Assets}$
- $Y_4 = \text{Current Liabilities}/\text{Current Assets}$
- $Y_5 = \text{Net Income}/\text{Total Assets}$
- $Y_6 = [\text{Pretax Income} + \text{Depreciation} + \text{Amortization}]/\text{Total Liabilities}$
- $Y_7 = \text{Indicator variable which is 1 if cumulative Net Income is negative for the last two consecutive years and 0 otherwise}$
- $Y_8 = \text{Indicator variable which is 1 if owner's equity is negative and 0 otherwise}$
- $Y_9 = ((\text{Net Income}_t - \text{Net Income}_{t-1})/(\text{Net Income}_t + |\text{Net Income}_{t-1}|))$

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The Ohlson's score also is in another format by is given by Ohlson's and Lemmon 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 they have the same implication and you can find out reading this slide or reading the journal paper, which is during here.

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Ohlson's O-Score (with updated coefficients)

$$O = -5.91 + 0.04*Y_1 + 0.08*Y_2 + 0.01*Y_3 - 0.01*Y_4 + 1.20*Y_5 + 0.18*Y_6 + 0.01*Y_7 + 1.59*Y_8 - 1.10*Y_9$$

}

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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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Values of Z-Score and O-Score for Philips India Ltd.

Year	1990	1991	1992	1993	1994	1995	1996
Z-Score	2.120479	2.787238	3.283604	4.265834	4.423882	3.983140	3.685362
O-Score	3.890588	3.843578	4.205020	5.147435	5.032618	4.731958	4.320980

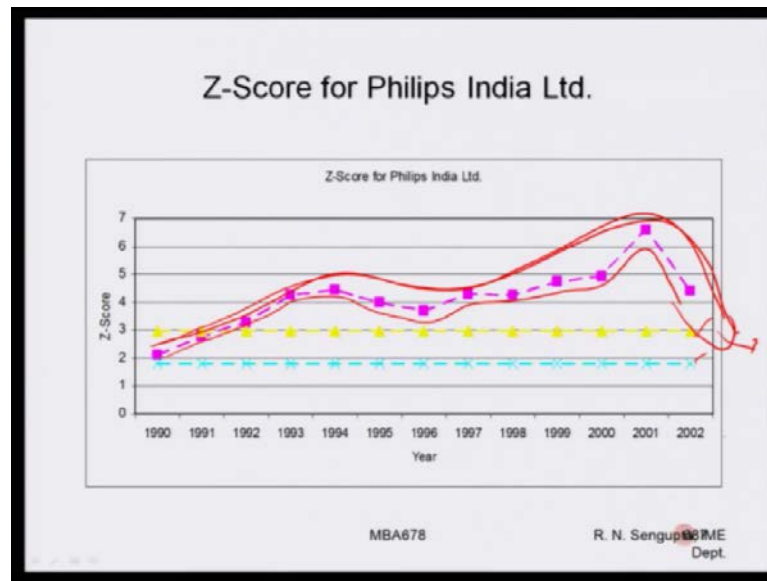
Year	1997	1998	1999	2000	2001	2002
Z-Score	4.290883	4.239720	4.728869	4.920595	6.577242	4.412970
O-Score	4.718085	4.761340	5.059113	5.081353	5.994083	5.038103

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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.

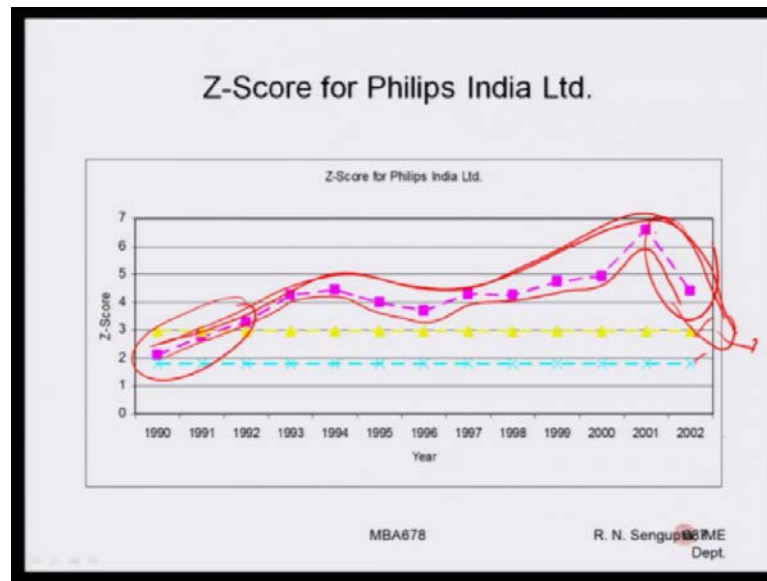
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So, if I consider the scores this one the pink the blue one and the yellow one I basically the, so let me see. So, this Z score is basically the all the ZETA score the Z score and the emerging market values, which are given for Philips from the 1990's 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.

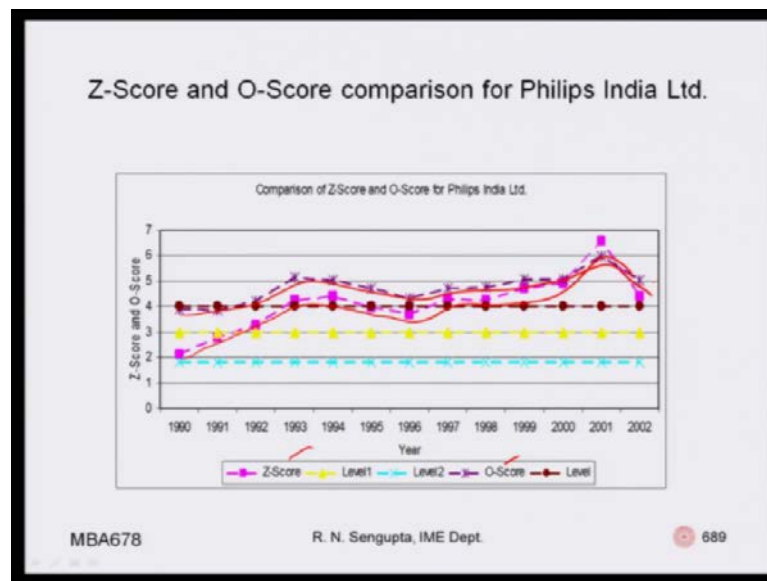
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Again, if you see the trend look me more play attention that the trend, this trend and the last one we, which we got using the Z score almost the same. So, which means in the models are specific to the internal set of information nothing to do with 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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Zmijewski's Model

Zmijewski, M. E., "Methodological issues related to the estimation of financial distress prediction models", *Journal of Accounting Research*, 1984, 22, 59-82.

Probability of failure = $\frac{1}{1 + \exp(-AS_1)}$

Where

$AS_1 = f(X_1, X_2, X_3)$

$X_1 = \text{Net Income/Total Assets}$

$X_2 = \text{Total Debts/Total Assets}$

$X_3 = \text{Current Assets/Current Liabilities}$

Remember if the value of this probability is ≥ 0.5 then it implies bankruptcy, else the company is not bankrupt

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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 , X_3 , 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 it implies bankruptcy else the company is not failed so; obviously, and this can be done for all this modules take in separately.

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Zavgren's Model

Zavgren, C. V., "The prediction of corporate failure: the state of the art", *Journal of Accounting Literature*, 1983, 2, 1-33.

Probability of failure = $1/[1 + \exp(-AS_2)]$

Where

$AS_2 = g(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8)$

- X_1 = Net Income/Total Assets
- X_2 = Average Receivables/Average Inventories
- X_3 = Current Assets/Current Liabilities
- X_4 = (Cash + Marketable Securities)/Short-term assets + Long-term Assets + Intangibles
- X_5 = (Cash + Marketable Securities)/Current Liabilities
- X_6 = EBDIT/Long-term Liabilities + Stockholders' Equity
- X_7 = Long-Term Debt/(Total Equities - Short-term Debt)
- X_8 = Net Sales/(Fixed Assets + Net Working Capital)

Remember if the value of this probability is ≥ 0.5 then it implies bankruptcy, else the company is not bankrupt

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To wrap it up we will just considered the last 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.