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The Use of Bankruptcy Forecasting Models in Teaching Applied Ratio Analysis in Investment and Financial Statement Analysis Courses

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Financial ratio analysis is a topic covered in most business courses in accounting and finance, but the traditional methodology used suffers from what can be termed the "cookbook approach." Students are typically assigned simple exercises at the end of chapters which involve the computation of ratios measuring liquidity, leverage, turnover and profitability. Students are then asked to compare the calculated ratios to a given industry average. These are merely sterile exercises which fail to expose students to the application of financial analysis in real world scenarios. A more effective curriculum would incorporate a complete analysis of actual firms, using sophisticated techniques which have been proven to be more effective in assessing financial strength.

INTRODUCTION

Traditional financial analysis is taught at nearly every business school in the country, with a strong focus on the computation and interpretation of financial ratios. Textbooks in investments, financial statement analysis, financial management and accounting all have chapters dealing with financial ratios. In many instances, the teaching methodology suffers from what could best be described as a "cookbook approach." Students are taught to calculate and apply financial ratio analysis by solving a series of textbook problems which provide little context and no information beyond the financial statements. Nothing is said about the nature of the company, its product lines, marketing strategies, financial policies, and the state of the economy or other relevant external and internal factors. Students are simply required to compute a set of financial ratios and then to compare their results to industry averages. This highly important topic can be made far more interesting, rigorous and meaningful by having students evaluate "real" companies. Students in our finance courses are required to conduct an in-depth analysis of several firms in an industry and, along with the application of an established model, to assess a company's financial condition over time. This more experiential learning approach also brings the students closer to having the

engage students in a broader discussion. If these types of ratios are effective in measuring particular aspects of a firm's financial condition, is it possible to combine these measures into a single formula to produce an overall index indicating a firm's financial well-being? Not surprisingly, the answer to the question is "yes." [1]

Our students are then introduced to statistical and mathematical techniques that have vastly increased the power of traditional financial analysis by combining the traditional ratios into formulae useful in assessing financial health.[2] The well-known **Altman Z Score** (1968) is an example. The model combines ratios from all four of the above categories into a single equation to produce a predictive index of financial stress. The model is shown below:

$$Z= 1.2X_1 + 1.4X_2 + 3.3X_3 + .6X_4 + 1.0X_5 \quad (1)$$

X_1 through X_5 are ratios that measure each of the aspects of financial strength.

X_1 = net working capital to total assets: [CA-CL]/TA (a liquidity ratio)
X_2 = retained earnings to total assets: RE/TA (a profitability ratio)
X_3 = operating profit to total assets: EBIT/TA (a profitability ratio)
X_4 = market value of equity to book value of debt: MVE/BVD (leverage ratio)
X_5 = operating revenues to total assets: REV/TA (a turnover ratio)

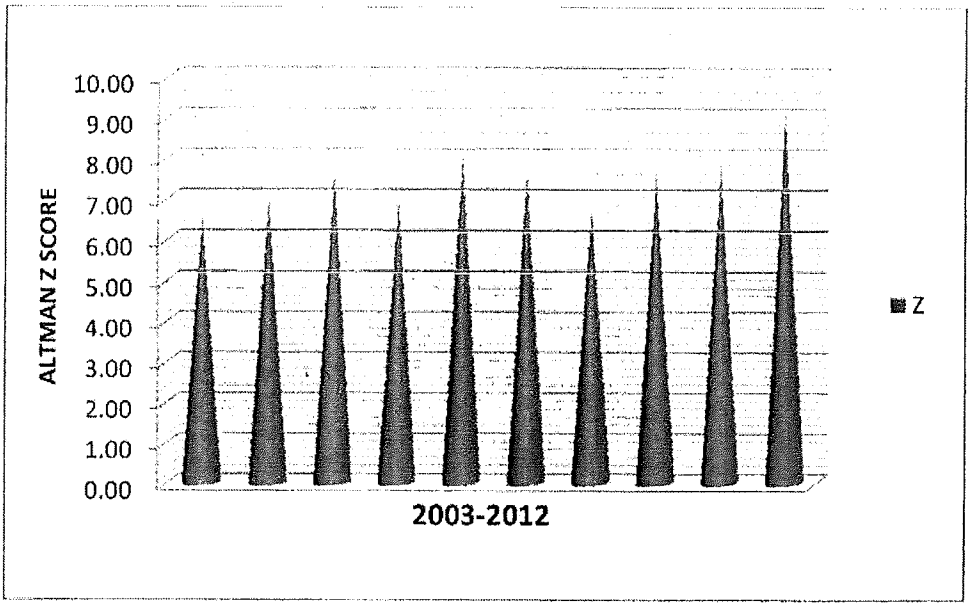
The model is the result of a Multiple Discriminant Analysis (MDA). To explain MDA to students, it helps to begin with a straightforward multiple regression such as forecasting automobile sales. Students are asked to identify the key variables that might help forecast cars sales (**Y**) for the upcoming year. With minimal prompting, students are usually able to enumerate the various factors that would help explain sales—factors like disposable income, price, the cost of financing, population growth, and so on. The Y variable can then be shown as a linear function of these explanatory **X** variables. For example:

$$Y= a_0 + a_1X_1 + a_2X_2 + a_3X_3 + a_4X_4 \quad (2)$$

where X_1 = disposable personal income
X_2 = suggested retail price
X_3 = interest rate on auto loans
X_4 = population growth rate

Students are shown that in such regression models, the dependent or **Y** variable and all of the independent or **X** variables are generally quantitative variables measured on an interval or ratio scale. MDA can then be described as a

Figure 1. Ten-year Z Score Results



income statements and balance sheets for the years 2003-2012 and the calculated Z Scores for each year. Using the data from 2012 to illustrate, Nike's Z Score is calculated as

$$Z = 1.2(.496) + 1.4(.361) + 3.3(.197) + .6(9.788) + 1.0(1.56) = 9.21 \qquad (3)$$

Figure 1 is a plot of the ten year **Z Score** results.

Since Nike's **Z Scores** are well above the 2.99 marker, and have been consistently so for a long time, Altman's model forecasts strong financial strength for the company. Particularly noteworthy here is the strong contribution of variables X_4 and X_5. Nike's low degree of financial leverage, as evidenced by the very high MVE/BVD ratios over time, and its high capital turnover (REV/TA), are the major contributors to its excellent scores.

For industries in which companies lease a significant amount of their assets, a modified version of the Altman model can be used. U.S. airlines and trucking firms, for example, often lease a very high percentage of their fleets using operating or short-term leases. Under current accounting principles, these leases do not have to appear on the firm's balance sheet as long-term debt. Instead the rentals are recorded in footnotes to the balance sheet. Where this is the case, the **Z**

important that students select an industry that they find particularly interesting or relevant to their job prospects, as this should increase their motivation and also potentially important, their hiring interviews. The students are required to summarize the economic and financial characteristics of the selected industry and companies, describe that industry's products, and to do a SWOT analysis (strengths, weaknesses, opportunities, threats). They must then create an Excel spreadsheet to analyze the several key competitors within the industry using the appropriate model. Since our intent is to give students "hands-on" experience with the model(s), they are not permitted to use data sources that directly provide **Z Scores** (Bloomberg and gurufocus.com, for instance).

Students are required to perform the analysis for a period of 10 years or more because the trend in scores is frequently as important as the level of those scores. In addition to charting **Z Scores**, they must also chart each of the ratios in the model used and to be prepared to fully discuss the factors affecting those ratios and their impact on the overall scores. Finally, each student is required to submit a comprehensive paper describing the results obtained. These results are compiled in summary form and discussed, compared and contrasted in a dedicated class at the end of the semester.[5]

ADDITIONAL TOPICS

To complete the discussion, our students are introduced to the idea that models built from data for a specific industry might be more powerful. All the Altman models are based on generic data; that is, they were designed using many different industries in the samples. But models can be, and have been, designed for specific industries. Our discussion includes an example.

Since the airline industry has seen a number of very high profile bankruptcy filings after deregulation, one such industry specific model called P-SCORE is discussed at this point. This model was generated by Pilarski (1999) using only air carrier data.[6] P-SCORE is a logit model of the form:

$$W = -1.98X_1 - 4.95X_2 - 1.96X_3 - 0.14X_4 - 2.38X_5 \quad (6)$$

Where:

X_1 = operating revenues/total assets
X_2 = retained earnings/total assets
X_3 = equity/total debt obligations
X_4 = liquid assets/current maturities of total debt obligations
X_5 = earnings before interest and taxes/operating revenues

The number P is determined by: $P = 1/[1+e^{-W}]$

Several of the input ratios (X_1, X_2 and X_3) are the same variables from the

Table 3. Airline P-Scores

	2009	2010	2011	2012
AMERICAN	0.305	0.444	0.391	0.527
DELTA	0.661	0.438	0.333	0.310
UNITED	0.479	0.504	0.316	0.161
USAIR	0.202	0.241	0.115	0.102
ALASKA	0.114	0.080	0.044	0.033
SOUTHWEST	0.010	0.007	0.010	0.009

CONCLUSION

While traditional ratio analysis has been taught in accounting and finance courses for many years, the topic is often presented in a way that is sterile and devoid of any "real world" aspects. Students are typically given a balance sheet and income statement and are taught to calculate ratios to measure factors like liquidity, leverage, turnover, and profitability. Missing is any real discussion and analysis of the industries and companies they are being asked to assess. We replace this "cookbook" approach used in many textbooks with a far more dynamic, interesting and relevant approach to applied financial ratio analysis. By requiring students to analyze actual companies over time, and by combining the traditional approach with newer quantitative methods such as MDA, students are offered a greatly enhance learning experience.

ENDNOTES

[1]It helps to start with a practical example many students may already know. The NFL ranks quarterbacks with one number. It combines a number of statistics such as the percent of passes completed, yards per completion, yards per attempt, the touchdown to interception ratio, and other variables in order to answer the question of who is the "best" QB in the NFL. It is easy to then draw the parallel to our attempt to combine measures into one index that conveys the financial strength or weakness of a firm.

[2]At this point, our students are given two PowerPoint presentations via e-mail as an outline. They are also posted on our website. They can be accessed via the links provided in the references.

[3]The variable X_5 is biased because revenues from the operating leased assets are on the income statement, but some of the assets producing those revenues are

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