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VBA Final Project

Executive Summary

I have always been interested in the stock market and potential opportunities to invest money. As such, I am always looking for ways to gather useful data that will allow me to better determine the risk associated with a particular company's stock. While there are many ways to value a company and assess the risk associated with investing in its stock, I recently learned of an intriguing study that can accurately predict the probability that a company will go bankrupt in the near future.

This particular study was conducted Edward Altman in 1968 and its effectiveness was validated in a 2008 study. The study resulted in a formula developed by Altman which assesses the short-term liquidity and long-term solvency of a company and returns a z-score, which can be interpreted to determine whether or not a company is in danger of bankruptcy. This model has been proven to be quite successful and is able to predict with 95% accuracy if a company will go bankrupt within one year (72% accurate in two years). While this model would be irrelevant for long-term investors, it can be quite a useful tool for investors that are interested in riskier, shorter-term investments. This tool may also be used by lenders who wish to assess the credit risk of a particular firm.

In order to make this process easier, I wrote a program that pulls the data used in the calculation from the web and performs the z-score calculation. This program allows for multiple companies to be assessed at the same time.

Implementation

The main sheet in the worksheet is the "Bankruptcy Predictor" tab **(See Figure 1)**. This is the sheet where the user will interact with the program. After the user enters the stock symbol, they can run the program by clicking the "Calculate" button. After the program runs, the "Clear Data" button will clear the results and allow for a fresh start. The other tab that will be visible to the user is the "Key" tab **(Figure 2)**. Essentially, this tab provides an explanation about what the different z-scores mean. This tab will be useful after the program has run. There are three other tabs within the worksheet which are invisible to the user except when the model is running. These tabs are used to store financial information collected from the web so that the relevant data can be analyzed.

Figure 1

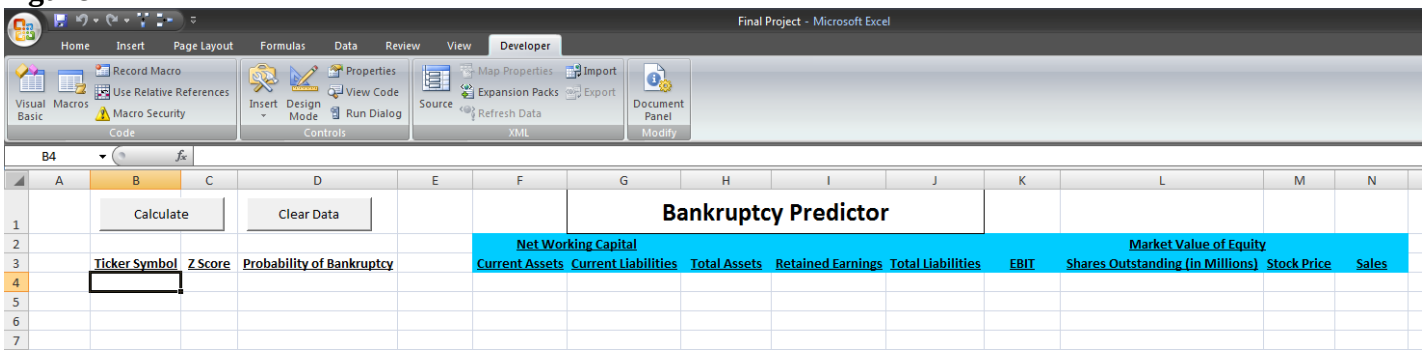
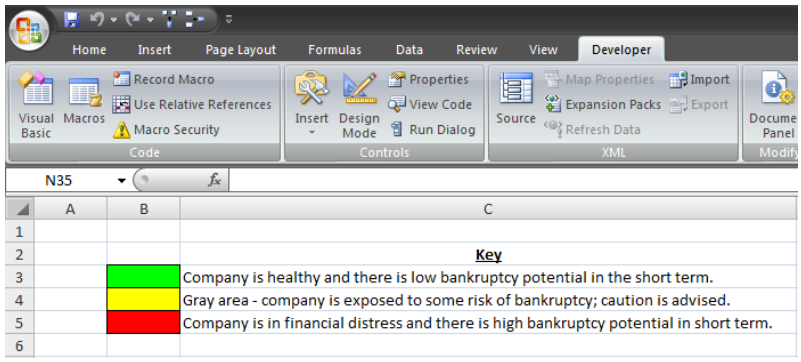
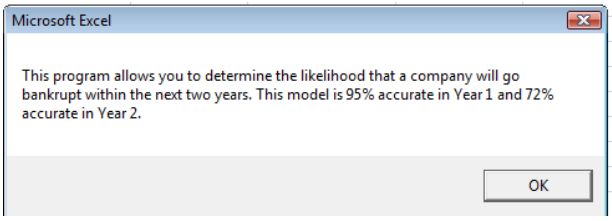
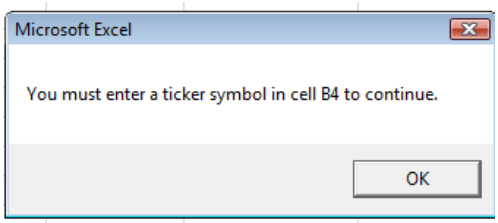


Figure 2





When a user opens the worksheet, two difference display boxes appear that provide important information to the user. The first box gives the user information about the functionality of the program and how accurate the estimates are. The second box that appears informs the user about restrictions related to the model. Specifically, the model is unable to calculate a z-score for financial institutions. This is true for two reasons. First, financial institutions don't report current assets and current liabilities on the balance sheet. As a result, the model will not run correctly without these values. Second, there are qualitative issues that would cause the model to return a z-score that is not comparable to other companies.



After viewing the message boxes, the user will be able use the program. Using the program is as simple as entering the stock symbol of the desired company in cell B4. If the user would like to analyze additional companies, additional stock symbols can be entered in subsequent rows in the same column (Column B). If the user fails to enter a symbol in cell B4, the program reminds the user that a symbol must be entered in this cell. If an invalid symbol is entered in a cell or if any of the data is not collected, it will return an error message to the user.

If a valid stock symbol has been entered and the Calculate button is clicked, the program will begin to run. The financial data is collected from the internet and presented on the "Bankruptcy Predictor" sheet. This data is then used in a formula **(Figure 3)** which calculates the z-score. If the z-score is greater than 3, the company is in no danger of bankruptcy. If it is less than 3 but greater than 1.8, the company is in the "gray area," which means the investor must take caution. A z-score less than 1.8 is an indication that the company is in distress and that it is highly likely that the company will face bankruptcy in the short-term. Finally, the z-score is translated into a percentage probability which is easier for the user to interpret **(Figure 4)**. If the user wishes to start over, they may click the "Clear Data" button to start over with a clean sheet.

Figure 3

$$ZScore_t = 1.2\left[\frac{NWC_t}{TA_t}\right] + 1.4\left[\frac{RE_t}{TA_t}\right] + 3.3\left[\frac{EBIT_t}{TA_t}\right] + 0.6\left[\frac{MVE_t}{TL_t}\right] + 1.0\left[\frac{Sales_t}{TA_t}\right]$$

NWC – net working capital (current assets minus current liabilities)
TA – total assets
RE – retained earnings
EBIT – earnings before interest and taxes
MVE – market value of equity
TL – total liabilities

Figure 4

Calculate | Clear Data

Bankruptcy Predictor

			Net Working Capital						Market Value of Equity		
Ticker Symbol	Z Score	Probability of Bankruptcy	Current Assets	Current Liabilities	Total Assets	Retained Earnings	Total Liabilities	EBIT	Shares Outstanding (in Millions)	Stock Price	Sales
F	0.93	25.90%	48,875,000	60,206,000	164,687,000	-7,038,000	165,360,000	7,149,000	3,729.25	10.75	128,954,000
WCN	2.53	1.61%	215,561	253,537	2,915,984	858,887	1,549,835	265,610	111.86	31.97	1,319,757
AAPL	8.31	0.00%	44,988,000	27,970,000	116,371,000	62,841,000	39,756,000	34,205,000	929.41	390.66	108,249,000
WM	1.88	6.84%	2,482,000	2,485,000	21,476,000	6,400,000	15,216,000	2,104,000	460.33	30.57	12,515,000

Learning/Conceptual Difficulties

During the course of this project, I feel that I learned more about how to program using VBA than I did throughout the rest of the course. That said, I wouldn't say that I didn't learn anything before I started this project. In fact, this class has taught me a lot of useful tools. Nevertheless, this project was a great experience for me and I really enjoyed working on it and felt like I was able to overcome the majority of the challenges I faced.

Before beginning my project, I ran into a major roadblock. My initial idea was going to be a project related to my job on campus. I work at an office that requires its employees to master a vast amount of information. My idea was to write a program that would gather the information from a variety of web pages and format it in the spreadsheet in a useable manner. However, after talking with Dr. Allen, we determined that the project was not well suited for VBA. This made it more difficult for me as I had to come up with yet another idea that I was interested in. fortunately, after some thinking and research, I came up with an idea that I'm very glad I chose for my project.

One of the initial difficulties I experienced was determining the scope of the project. At first, I considered including other elements into the project. This including using other models that investors use to value stock and investment options. However, after performing some research and spending time on the initial steps of my final project, I was satisfied with how robust the model turned out. I determined that adding other models might only complicate the functionality of the program, leading to confusion for the user.

After I began the project, one of the biggest challenges I faced was finding information on the internet that would be usable. I spent a number of hours researching data on different financial websites in order to obtain data that would be formatted similarly. Fortunately, after searching on at least ten different sites, I was able to obtain all of the information I needed from just three websites. I was able to collect the income statement data from Yahoo Finance. I also obtained the balance sheet data from Yahoo Finance, but on a different page. The most difficult part was gathering information about the number of shares outstanding. While this data was available on many websites, it was typically formatted in a way that would make it more difficult to include the number in a formula. Finally, I found information on the Bloomberg website that was much easier to work with. The listed shares outstanding were listed in millions, but abbreviated (e.g. 235.4). So, when I plugged this number into the formula, I just had to multiply it in order to scale it correctly with the remaining data.

Another issue I encountered was figuring out how to get the formula for calculating the z-score to work. While I had a general understanding about how to program formulas into the code, I found it to be much more difficult to figure out how to use them when referencing cells that are constantly changing. After performing quite a bit of research, I eventually figure out how to use the FormulaR1C1 feature. This feature essentially allows the programmer to reference the cells in the formula based on the cell that the formula is being written in. Therefore, instead of naming an actual cell address as the reference, the cells included in the formula were relative to the active cell. Once I discovered the R1C1 feature, it was much easier to achieve my goal.

One final issue that I will mention was the difficulty I experience when trying to format the data to be presented in table format. After experimenting for a while with this issue, I could not get the data formatted as a table. After much trial and error, I was about ready to give up. Then, I had an idea that I thought would allow me to get the data appear as if it were in a table without actually creating a table object. Essentially, I programmed it in a way such that every other row would be given a different color background. After I worked through the kinks, I was able to get this to work out very well. A separate, minor issue I experienced with the tables was writing the code in a way that would get the table to format only the data I wanted it to. This wasn’t very difficult but did challenge me a bit.