

END USER MODELLING

FINAL PROJECT

April 4, 2009

Professor: Nicolas Fermin Cota



Sunesson Samuel | Peder Albert | Rocky Andaya | Chan Chun Yip | Herzog Cornelius |
Johanne Li | Didi Nishlis

Introduction

This program is made up by two tools:

- The first one is a **performance overview of a given stock**. The user has just to determine the ticker of the stock, the period of study and the frequency of the returns and the program retrieves the data from Yahoo Finance. It also includes additional options: for instance, the user can decide whether to collect information about competitors' performances or not. Besides, a drop down list of several indexes is provided, so that the user can compare the graph of its stock to the one of the benchmark.
- The second tool, called **efficient portfolio creator**, builds a minimum variance portfolio, which gathers stocks among those specified by the user and under conditions the user previously set. It automatically collects data from Yahoo Finance and does the analysis by using the solver function.

Stock performance overview tool only aims at retrieving information about the chosen stock and displays them in a structured, well-organized and graphical way; whereas the purpose of the second tool is to generate the most efficient portfolio among a set of possible stocks.

1. Stock Performance Overview

The sub creates a dynamic and exhaustive overview of the stock performance of a specific company relative to its competitors and to the Dow Jones Industrial benchmark. All the historical data are collected and updated from the internet. Once the program is run, a new worksheet is created and the results are summarized in three graphs: Performance & Volume, Stock vs. Index and Competitor's Performance.

1.1 Characteristics of the company

In the very left corner of the worksheet, the sub displays the key characteristics of the stock. All the indexes under which the company is registered are shown under "Index

Membership". Should the investor need further information about the indexes, he is given the possibility to click on the appropriate link.

This being done, the sector and the industry of the company are then presented under the respective headings, followed by the number of the company's employees.

Finally, if data concerning the company's competitors are available, they will be gathered under the last heading. As a consequence, the Competitors Performance graph enables us to compare our stock performance to rival companies' performances.

1.2 Stock Price History

Information about the selected stock are collected from the internet. The user can choose whatever ticker available on Yahoo Finance website, the period of time in which he is interested in and the frequency of the data (the possible frequencies are daily, weekly and monthly). Data for open, high, low, close and adjusted close are listed along with volume in the first table in the right side of the worksheet. Based on the closing stock price data, two different moving averages are calculated. The number of time periods used to calculate the two moving averages can also be easily modified in the user form. Data for the moving averages are also presented in the first table along with the stock data.

The results are to be seen in the first graph – Performance & Volume. Here, historical stock prices and the two different moving averages for the chosen period are displayed on the left y-axis. Volume is presented on the right axis. Generally speaking, the two moving averages are said to give information about trends and trend reversals. One common trading strategy is to buy a stock when the fast moving average crosses the slow moving average from below_ sometimes it is constrained by the fact that there has to be a positive first derivative for the slow or both moving averages. The strategy would recommend going short should the opposite happen.

1.3 Stock vs. Index

Stock performance in itself does not tell too much about the performance of the firm. In order to better assess the firm's financial health, we compared it to the Dow Jones Industrial index in the Stock vs. Index graph. The performances of the two are presented on different axes – the stock performance is presented on the left y-axis and the performance of the index is presented on the right y-axis. This graph can be used to analyze to what extent the stock performance is linked to the general market.

1.4 Stock vs. Competitors

In order to further analyze the performance of the selected firm performance it is relevant to compare it to the performance of comparable stocks (refer the graph titled Stock vs. Competitors). In combination with the Stock vs. Index graph, this graph is useful to investors for several reasons. Firstly, it can be used to measure the firm intrinsic performance by eliminating the effect of macroeconomic factors under the global market conditions. Secondly, it provides information that could be useful for actual trading. For example, a sudden drop in prices relative to both the general index and the competitors could potentially offers an opportunity to go long in the stock (since we expect that the demand for the comparables will be diverted towards our company); on the other hand, the industry risk could potentially be reduced by going short in the diversified index. Moreover, this would also provide a source of financing.

2. Efficient Portfolio Creator

This sub runs a solver that, for a given level of risk (measured by the standard deviation), maximizes the portfolio return by allocating the appropriate weight to each stock the user chose. It does so by first retrieving closing prices from Yahoo Finance on a new worksheet,

then calculating the change in price and the covariance between each stock of the portfolio and finally running the solver. The result appears in the cells under the covariance data.

2.1 User Form

The user can pick stocks in the user form by typing each ticker separated by “,”. If the user does not want to explicitly choose the stocks, he can try a random sample of stocks. The user has to decide the maximum level of risk he is willing to take (standard deviation). He chooses the start and end dates and the frequency of the data (daily, weekly or monthly). The user can plug the minimum and the maximum weights for the stocks. He is also able to decide whether short selling is allowed or not. Now, he has just to click on Go and let VBA do the work.

2.2 Data

As mentioned above, the sub first creates a new spreadsheet. In this spreadsheet, it retrieves the historical closing prices from Yahoo finance for the selected stocks according to the time interval chosen by the user. In the last row of this table, we calculated the return on the stock for the whole time period and then the changes in stock prices for each interval. The later operation is done with an if statement that displays the value 0 if there is no closing price for a specific day and calculates the natural logarithm of the changes if the corresponding closing price is actually available. For each stock, it also gives the standard deviation which is to be seen at the bottom row of the table. In the first column, a function finds the maximum and the minimum standard deviations among the chosen stocks. Moreover, it calculates the covariance between all the pairs of stocks and creates a covariance matrix. The variance of a single stock is highlighted in blue cells. We have decided to not hard-code the covariance calculations for several reasons. First of all, being able to see the formula helps users to better understand the function. Second, it also gives the user the possibility to make personal changes in the data and to transform the

spreadsheet, depending on his preferences. Nevertheless we are conscious of the trade off, since the program will take more time to run. However, since the solver's capacity is limited to 255 stocks, the possible saving of time is not significant enough.

2.3 Solver

Before running the solver, each stock is allocated an equal weighting in the portfolio. Afterwards, the solver runs with the objective to maximize the portfolio return under the constraints set by the user. When the solver finds a solution, it is shown in highlighted cells. The standard deviation, the sum of weights (which should always be 100%) and the expected return will be displayed. However, there is a problem with the solver when there are no solutions; because it will try to find another solution, which is not always accurate. For example, this case will happen if the user chooses a standard deviation too low to be reached for the given set of stocks.

3. Coding

The two parts of the programs are stored in two different modules: modStockAnalysis contains the code for the performance overview while modMinVarPort contains the code for the efficient portfolio creator.

ModMain contains shared functions as well as modGetStockData. The other modules contain tools for cleaning HTML, formatting numbers, and controlling Excel worksheets.

3.1 ModStockAnalysis

ModStockAnalysis consists of different functions and declarations. The type enInfo is used to store big parts of the information retrieved about a company. This allows to re-use data easily when adding other projects. The main function (which is called from the user form) takes a lot of parameters as input to determine the different settings. It creates the basic

layout and data for the performance overview. Depending on the users selection the two subs displayPerformance and displayCompetitors are called.

DisplayPerformance retrieves the stock data for the given range from Yahoo and calculates moving averages for given time periods using the calculate MovingAverage function.

Afterwards it creates a chart with the stock price, trading volume and the moving averages. If the index overlay option was activated another chart with index data compared to the stock data will be created as well.

DisplayCompetitors fetches the direct competitors (that are publicly traded) from Yahoo and creates a relative competitors index chart starting at 100% for each competitor.

3.2 ModMinVarPort

To calculate the efficient portfolio the function minimumVariancePortfolio is called with the specified parameters. After adding a new worksheet this function invokes the function addStock for each ticker. AddStock fetches the ticker data from Yahoo and returns it to the worksheet. At the end of the stock data the return of each stock over the given time period is calculated. Then the sub calcContinuousReturns calculates the logarithmic changes in stock prices that will be used to calculate the covariance of two stocks in the border covariance matrix by the sub calcCovarianceBorderMatrix.

To optimize the portfolio all weights are equally distributed to the stocks and for that the expected return and the standard deviation are calculated. Afterwards the solver is initialized by the user given constraints and tries to optimize the portfolio.

Both parts of the program make use of three useful functions: findFreeCol, findFreeRow, addSizetoA1. The two first of them find, as the name implies, a free column or a free row. This is necessary since we don't know how many tickers or data the output will consist off. The last

one is used to calculate the different ranges. To assign a range in Excel something like A1:B4 must be used. But since it is not so easy to say A1 + 1 column = B1 this function is used. It converts the A1 notation of cell addresses into the R1C1 notation (R1C1 means row 1 column 1 which exactly equals A1), splits it up and adds the given number of rows and columns and converts it back into A1 notation.

Furthermore there are two functions to help with charts. RemoveUnwantedSeries removes all series from a chart since Excel tries to guess which series a chart should include when a chart is created. ArrangeMyCharts locates all charts in one worksheet nicely by given widths, heights and other spacing parameters.