Final Project Report

Aaron Ball | MBA 614 | 11 Apr 2012

Executive Summary

This final project was created for the BYU BUSM 418 Financial Planning class that is taught by Dr. Bryan Sudweeks. In this course, a number of financial teaching tools have been made available for the students to help them both in the course and throughout their lives. Each tool is focused on providing assistance in some area of personal finance.

Under the direction of Dr. Sudweeks, an excel VBA spreadsheet was developed to be used in the investing section of the course to assist students in evaluating the historical performance of mutual funds. The developed solution uses VBA code to connect via the internet to Morningstar.com from which fund data is gathered and assembled into customized reports based upon selections made by the user. The tool only works on PCs, requires Internet Explorer, and an active internet connection.

Implementation Documentation

Completion of the mutual fund evaluation tool (MFET) was accomplished by functionally decomposing the project and completing a process of individual steps. The implementation of the tool will be described according to these functional categories. However, the order in which they are described follows more of the flow of how the tool is used and not the order in which the code was developed, necessarily.

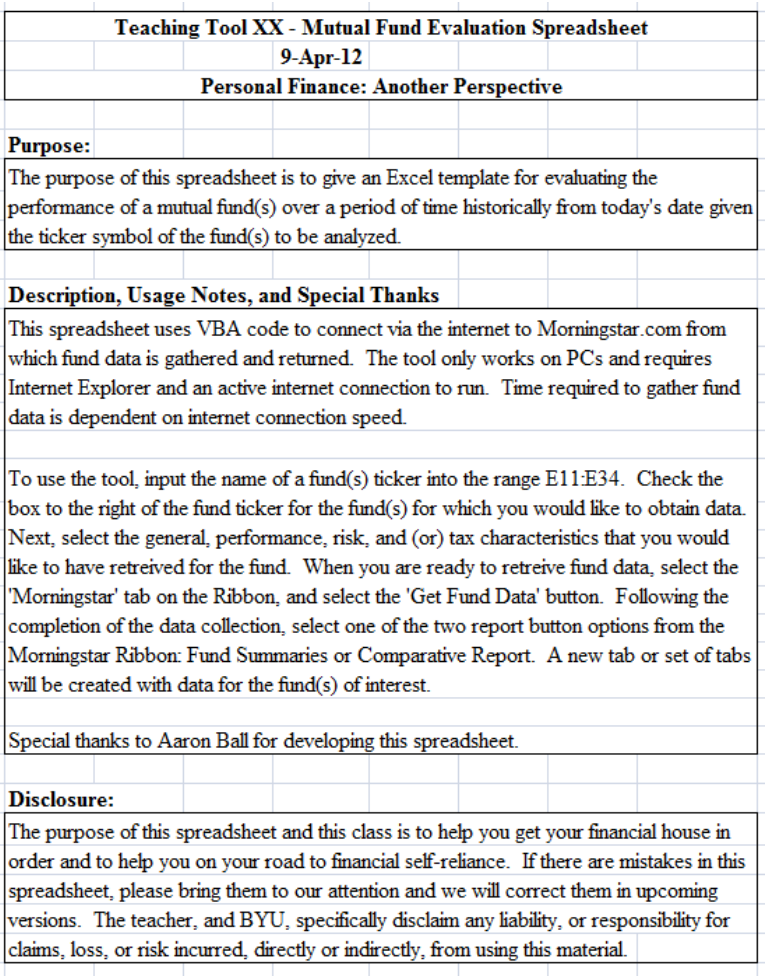
Introduction Tab

The MFET was designed to follow a design scheme similar to that of the other learning tools in the course. Each tool has an introductory tab that explains the use of the tool with a disclosure to protect the university. An introductory tab was designed to match the learning tool design scheme and was filled with appropriate explanatory content, as shown in Figure 1 (next page).

Dashboard

The 'dashboard' tab provides a simple user interface from which the user specifies a variety of options including designating the fund(s) for which data will be obtained, and the specific types of data to be gathered. The dashboard was designed also to follow a design scheme used in other teaching tools wherein cells that the user should change or modify have a green background color.

The dashboard is separated into two primary sections, a Fund(s) section and a Characteristics of Interest section, as shown in Figure 2 (page XXX). In the funds section, cells are indicated wherein fund tickers should be typed. In addition, checkboxes are found to the left of each row where a fund ticker can be placed. This was done so that if students have a number of funds of interest, but only wish to have the tool gather data for select funds, this can be accommodated.



Teaching Tool XX - Mutual Fund Evaluation Spreadsheet

9-Apr-12

Personal Finance: Another Perspective

Purpose:

The purpose of this spreadsheet is to give an Excel template for evaluating the performance of a mutual fund(s) over a period of time historically from today's date given the ticker symbol of the fund(s) to be analyzed.

Description, Usage Notes, and Special Thanks

This spreadsheet uses VBA code to connect via the internet to Morningstar.com from which fund data is gathered and returned. The tool only works on PCs and requires Internet Explorer and an active internet connection to run. Time required to gather fund data is dependent on internet connection speed.

To use the tool, input the name of a fund(s) ticker into the range E11:E34. Check the box to the right of the fund ticker for the fund(s) for which you would like to obtain data. Next, select the general, performance, risk, and (or) tax characteristics that you would like to have retreived for the fund. When you are ready to retreive fund data, select the 'Morningstar' tab on the Ribbon, and select the 'Get Fund Data' button. Following the completion of the data collection, select one of the two report button options from the Morningstar Ribbon: Fund Summaries or Comparative Report. A new tab or set of tabs will be created with data for the fund(s) of interest.

Special thanks to Aaron Ball for developing this spreadsheet.

Disclosure:

The purpose of this spreadsheet and this class is to help you get your financial house in order and to help you on your road to financial self-reliance. If there are mistakes in this spreadsheet, please bring them to our attention and we will correct them in upcoming versions. The teacher, and BYU, specifically disclaim any liability, or responsibility for claims, loss, or risk incurred, directly or indirectly, from using this material.

Figure 1: Mutual Fund Evaluation Tool Introduction Tab Screenshot

Similarly for the Characteristics of Interest section, students are provided with four subsections (General, Performance, Risk, and Tax) each of which consists of a variety of options and checkboxes. As per direction of Dr. Sudweeks, the tool needed to enable the student to select characteristics of interest and only return those pieces of data. This flexibility was accomplished through using checkboxes in this area of the Dashboard as well. Descriptions of each of the parameters in the Characteristics of Interest section was not included in the tool as these are discussed in detail in the course and students that use the tool will have an understanding of their meaning.

Error checking code was also implemented to help ensure smoother performance of the MFET. For the Fund(s) section of the Dashboard, error checking code was implemented to ensure that if a checked box was next to a blank fund ticker cell, that an error message would be displayed and the data retrieval process would be aborted. Also, prior to parsing the Morningstar.com site for the desired characteristics, a test would be performed to ensure that the fund name actually existed, and if not, that fund data would not be pulled.

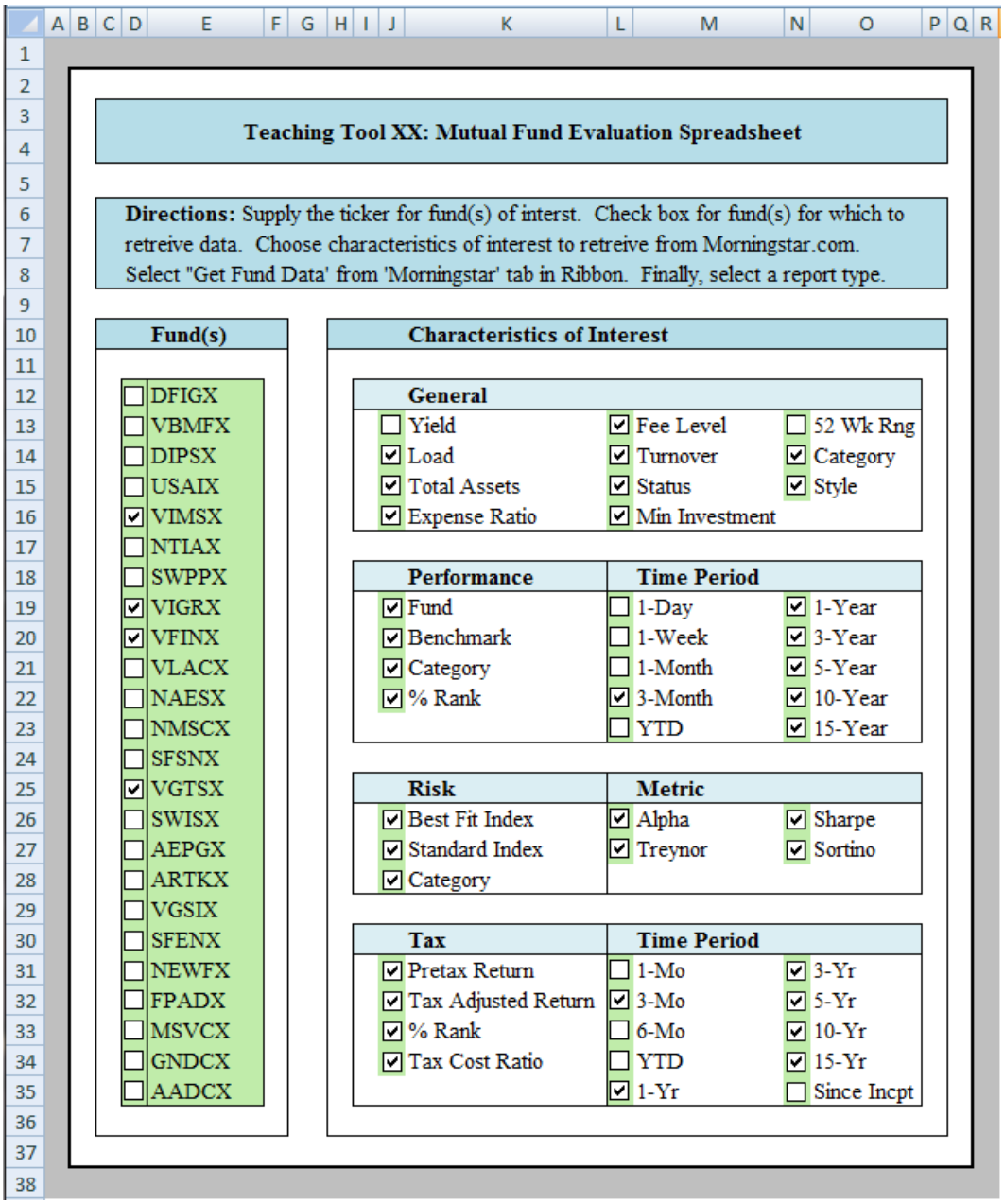


Figure 2: Mutual Fund Evaluation Tool Dashboard Screenshot

For the Characteristics of Interest section of the Dashboard, the required error checking was more involved. For the Performance, Risk, and Tax subsections, both an option and either a metric or time period needed to be selected in order for data to be retrieved. To ensure that this was done, code was written to check that if at least one of either an option or a time period was selected that at least one of the corresponding data selections was marked. If this was not supplied by the user, an error message would be displayed, such as the one shown in Figure 3 (next page). For example, if the user didn't select any of the three risk options (Best-Fit Index, Standard Index, or Category) but did select one or more ratios (Alpha and Treynor), then an error message would result and the remainder of the program would be terminated.

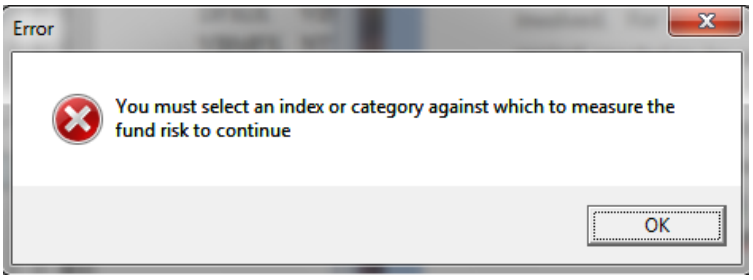


Figure 3: Error Message resulting from incompatible selection combination of Characteristics of Interest options.

In addition to performing this error checking, additional checks were performed to minimize the unnecessary code needed to perform the required task. For example, data is collected from four different pages on the Morningstar.com site that corresponds to the Characteristics of Interest subsections of the Dashboard tab. If the user specifies that no data is to be retrieved from any of the four subsections, then that portion of the data retrieval process would be bypassed. To accomplish both the error checking and the directing of data retrieval, loops were constructed to check each of the cells that are tied to the checkboxes in a particular subsection. Based upon which boxes were 'True' or 'False' the error checking and directing of data retrieval were accomplished.

Ribbon Design

After the user supplied appropriately formatted fund(s) and Characteristics of Interest options, the VBA code to retrieve data from Morninstar.com would be initiated by clicking the 'Get Fund Data' button of the custom designed 'Morningstar' tab appended to the standard Excel Ribbon (Figure 4). The Custom UI Editor for Microsoft Office was utilized to develop the custom ribbon code necessary to create the ribbon GUI shown in Figure 4. Icons were found via Google Image searches and were chosen such that they appropriately described the action that would be completed for each VBA macro.

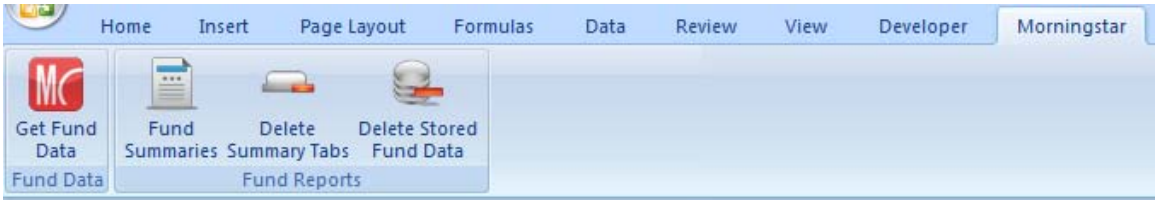


Figure 4: Custom 'Morningstar' ribbon tab with custom buttons and button groups.

In addition to the 'Get Fund Data' action, three other actions can be taken from the 'Morningstar' tab: create fund summaries, delete summary tabs, and delete store fund data. Each of these actions and the associated code to accomplish them will be detailed in later sections.

Progress Bar Form

After the user selects the 'Get Fund Data' button from the 'Morningstar' custom tab of the ribbon, a custom designed form is launched that resembles a progress bar to give the user status updates regarding the progress of the macro in collecting the specified data from Morningstsar.com. The

progress bar form is important because the VBA code that collects data from Morningstar.com can take a significant amount of time to run, especially if a slow internet connection is used and data for a large number of funds is being requested, and the progress bar helps to provide the user with confidence and real-time status updates in the progress being made behind the scenes while the code runs. The progress bar is shown in Figure 5.

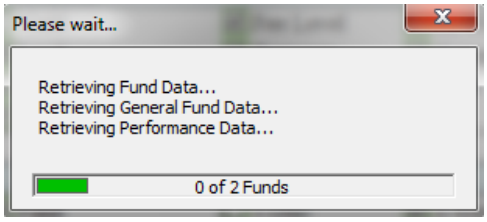


Figure 5: Progress Bar form shows real-time progress being made by VBA code.

There are several properties of the Progress Bar form that are important to note. First, the presence of the form does not impede the rest of the VBA code from running. Adding the 'vbModeless' parameter when executing the 'Show' method of the progress bar form facilitated this behavior, as shown in Figure 6. In addition, other visual cues were provided to help the user be convinced that there were things taking place behind the scenes such as causing the mouse pointer to change to the 'wait' format.

```
'Show the progress form and change appearance of curser, etc.
frmStatus.Show vbModeless
frmStatus.lblProgBar.Caption = "0 of " & numOfFunds & " Funds"
Application.Cursor = xlWait
frmStatus.MousePointer = fmMousePointerHourGlass
Application.ScreenUpdating = False
```

Figure 6: Code relating to launching the Progress Bar form and Excel's appearance during code run.

In addition, the Progress Bar form provided two other important pieces of information that were both independently updated as the VBA code progressed toward completion: visual status updates and textual status updates. First, a green bar showing the progress of the VBA code was developed. This code consisted of two label properties made to look like a progress bar and a progress bar frame. After specific sections of code were completed, the width of the progress bar (label property) was changed to reflect the appropriate change that had taken place. The change in width of the bar is dependent on several variables including the number of funds and the status of the sub-step being completed for each form. Code such as the following facilitated this expanding behavior of the progress bar.

```
frmStatus.lblProgBarIndicator.Width = 200 * ((curFundNum - 1 + (1 / 4)) / numOfFunds)
```

Textual updates were also provided as specific sections of code were completed. Also, if there were any errors in obtaining certain fund properties, these messages were also displayed in the text area of the progress bar form. The following line of code is an example of code used to accomplish this.

```
frmStatus.txtProgStatus.Value = frmStatus.txtProgStatus.Value + vbNewLine & "Retrieving Risk Data..."
```

Data Retrieval

The data retrieval process is initiated when the user clicks the 'Get Fund Data' button from the 'Morningstar' tab. This process is composed of four primary steps: retrieve general, performance, risk, and tax data, respectively. For each of these processes, the agent class module developed by Dr. Allen was used to provide a robust method to acquire a variety of fund characteristics. Each of the four steps of this process required navigating to a new Morningstar.com webpage and finding and retrieving the appropriate data on that page. A screenshot of the Morningstar.com 'Quote' page that contains the general fund data is shown in Figure 7. The pages containing data that is retrieved during this macro are highlighted in the image as is the general fund data on the shown Quote page.

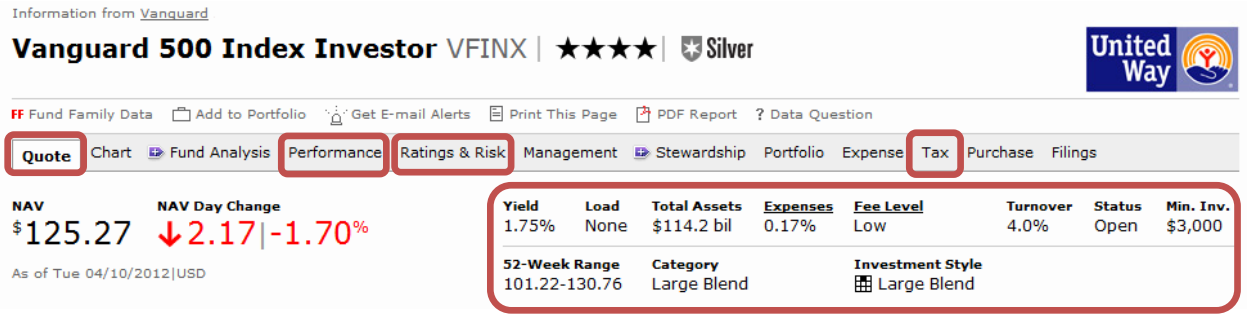


Figure 7: Morningstar 'Quote' page screenshot showing general fund data.

To ensure that the Morningstar.com pages had time to load before the HTML code was parsed, and to ensure that the desired page had been reached, several code segments were developed. At times, the Morningstar.com site is unable to deliver the requested fund page, and instead delivers a message indicating that the page is temporarily unavailable. Code was developed to check to see if fund information that would uniquely appear on the fund page was available before continuing to parse the page for fund characteristic data. If no unique fund text was found (such as the ticker for the fund), then the code would wait for a few seconds before reloading the page and attempting once again to have the correct page returned. If after three attempts the page was still not loaded, the user would be notified via the progress bar and the code would continue on to the next page.

Second, because of the nature of the Morningstar.com web pages, sometimes the 'openpage' method of the agent class would consider that the page had loaded completely and allow the following lines of VBA code to run when not necessarily all of the content containing the fund data had been loaded and displayed. To handle this behavior, a similar looping mechanism was applied whereby the code would attempt to gather a certain piece of information from the page, and if it was not found, the code would wait and try again, up to three times, before the retrieval process for that particular page would be abandoned.

Although the user can select a variety of characteristics to have the VBA code return, the code does not only find and retrieve the selected data characteristics. Instead, the code will retrieve all of the characteristics from a particular Morningstar.com page and when the fund reports are generated, only the desired characteristics will be displayed. The decision to have the code operate in this way was made based upon ease of implementation and because very little additional time is required to parse

and capture all fund characteristics from the page while that page is loaded. One important point regarding the retrieval process is that if no data is requested from one of the characteristic subsections, such as the performance subsection (which corresponds to data found on the Morningstar.com performance webpage), then retrieval for that page is not attempted at all, thus accelerating the retrieval process and aligning it with the users direction on a broader scale.

Prior to developing this code, the Morningstar.com robots page was consulted to ensure that this tool would not violate the site's policy regarding which areas of the site could be requested by VBA code or robots for data retrieval. Each of the pages visited by this code is not in violation of Morningstar.com's robot policy.

Data Storage

During the process of fund retrieval, gathered fund data is stored to the appropriate sheet in the Excel workbook. Each of the four sheets that serve to temporarily hold fund data are 'very hidden' to prevent easy access and or tampering by the user. The worksheet structure of the workbook is shown in Figure 8. Data was stored in this manner instead of just in project variables to enable the user to have more control over displaying and removing the fund tabs after the data retrieval macro had finished running.

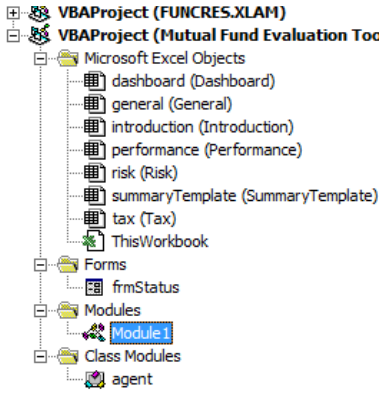


Figure 8: Screenshot showing the 'very hidden' tabs in the workbook.

If fund data for multiple funds is requested by the user, the data is stored in a repeated format on each of the hidden pages as shown in Figure 9.

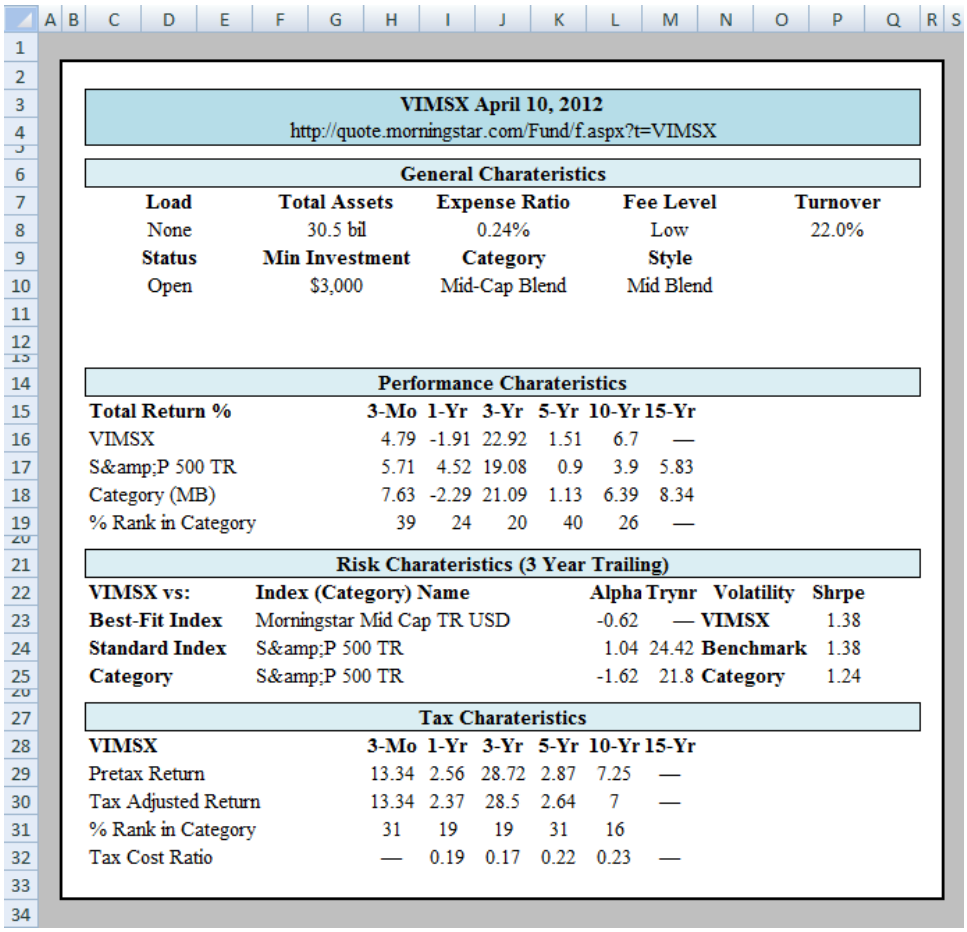
	A	B	C	D	E	F	G	H	I	J	K	L
1	**Fund**	**Yield**	**Load**	**Total Assets**	**Expense Ratio**	**Fee Level**	**Turnover**	**Status**	**Min Investment**	**52 Week Range**	**Category**	**Style**
2	VIMSX	1.04%	None	30.5 bil	0.24%	Low	22.0%	Open	$3,000	17.00-22.57	Mid-Cap Blend	Mid Blend
3	VFINX	1.75%	None	114.2 bil	0.17%	Low	4.0%	Open	$3,000	101.22-130.76	Large Blend	Large Blend
4	NEWFX	1.46%	5.75	19.3 bil	1.02%	Low	25.0%	Open	$250	43.50-57.43	Diversified Emerging Mkts	Large Growth

	A	B	C	D	E	F	G	H	I	J	K
1	**Total Return %**	**1-Day**	**1-Wk**	**1-Mo**	**3-Mo**	**YTD**	**1-Yr**	**3-Yr**	**5-Yr**	**10-Yr**	**15-Yr**
2	VIMSX	-2.25	-5.04	-3.13	4.79	8.3	-1.91	22.92	1.51	6.7	—
3	S&P 500 TR	-1.71	-3.84	-0.73	5.71	8.68	4.52	19.08	0.9	3.9	5.83
4	Category (MB)	-2.1	-4.91	-3.23	4.05	7.57	-4.34	20.23	0.65	6.03	8.23
5	% Rank in Category	64	52	42	39	36	24	20	40	26	—
6											
7	NEWFX	-1.81	-3.71	-2.67	6.93	9.08	-9.26	16.84	2.28	11.22	—
8	MSCI EAFE NR USD	-1.54	-4.91	-3.63	4.61	5.84	-12.08	12.87	-4.92	5.25	3.89
9	Category (EM)	-1.5	-3.78	-3.9	6.84	10.37	-14.39	18.63	1.14	12.57	7.17
10	% Rank in Category	88	28	19	50	74	18	71	34	71	—

Figure 9: Screenshot showing how general and performance data is stored during data retrieval.

Fund Report Creation

After the data retrieval process is completed, a call is made to a function that creates the reports for each of the funds of interest as specified by the user. A new worksheet is created for each fund and receives a name corresponding to the ticker of the fund. Formatting for the fund report worksheet is held by the 'very hidden' 'summaryTemplate' worksheet. It was discovered that a new worksheet cannot be made from a copy of an existing worksheet if that worksheet was 'very hidden' so several additional steps were required to copy the formatting of the cells, columns, and rows to create the correct format for each of the fund worksheets. An example of the fund summary worksheet is shown in Figure 10.



VIMSX April 10, 2012
http://quote.morningstar.com/Fund/f.aspx?t=VIMSX

General Charateristics

Load	Total Assets	Expense Ratio	Fee Level	Turnover
None	30.5 bil	0.24%	Low	22.0%
Status	**Min Investment**	**Category**	**Style**	
Open	$3,000	Mid-Cap Blend	Mid Blend	

Performance Charateristics

Total Return %	3-Mo	1-Yr	3-Yr	5-Yr	10-Yr	15-Yr
VIMSX	4.79	-1.91	22.92	1.51	6.7	—
S&P 500 TR	5.71	4.52	19.08	0.9	3.9	5.83
Category (MB)	7.63	-2.29	21.09	1.13	6.39	8.34
% Rank in Category	39	24	20	40	26	—

Risk Charateristics (3 Year Trailing)

VIMSX vs:	Index (Category) Name	Alpha	Trynr	Volatility	Shrpe
Best-Fit Index	Morningstar Mid Cap TR USD	-0.62	—	**VIMSX**	1.38
Standard Index	S&P 500 TR	1.04	24.42	**Benchmark**	1.38
Category	S&P 500 TR	-1.62	21.8	**Category**	1.24

Tax Charateristics

VIMSX	3-Mo	1-Yr	3-Yr	5-Yr	10-Yr	15-Yr
Pretax Return	13.34	2.56	28.72	2.87	7.25	—
Tax Adjusted Return	13.34	2.37	28.5	2.64	7	—
% Rank in Category	31	19	19	31	16	
Tax Cost Ratio	—	0.19	0.17	0.22	0.23	—

Figure 10: Fund summary worksheet containing requested characteristics of interest for particular fund.

Creating customized reports based on the data requested by the user led to the development of some relatively complex looping structures involving up to four counter variables to track the cells from which the data was being copied from and the cells to which data was being copied to. An example of one of these loops is shown in Figure 11. As a result, the fund reports are customized both according to the data requested within a particular subsection (i.e. Performance, General, etc.) as well as among the sections themselves.

```
i = 16 ' column counter for fund tab
j = 22 'row counter for fund tab
x = 6 'counter for performance page columns
y = 0 'to transition rows on performance page
For Each c In dashboard.Range("riskMetricsB")
    If c.Cells.Value = True Then
        Sheets(ticker).Cells(j, i).Value = risk.Cells((curFundNum - 1) * 5 + 1 + y, x).Value
        Sheets(ticker).Cells(j, i).NumberFormat = risk.Cells((curFundNum - 1) * 5 + 1 + y, x).NumberFormat
        y = 1
        For Each d In dashboard.Range("riskOpts")
            If d.Cells.Value = True Then
                j = j + 1
                Sheets(ticker).Cells(j, i).Value = risk.Cells((curFundNum - 1) * 5 + 1 + y, x).Value
                Sheets(ticker).Cells(j, i).NumberFormat = risk.Cells((curFundNum - 1) * 5 + 1 + y, x).NumberFormat
            End If
            y = y + 1
        Next
        j = 22
        i = i + 1
        y = 0
    End If
    x = x + 1
Next
```

Figure 11: Looping structure employing four counter variables to facilitate data transfer to fund report

For example, if the user only selects two general characteristics to be returned for a particular fund, then only those two characteristics are shown. If no characteristics are desired, for example, in the Performance section, then that section of the report is removed entirely.

If any fund report tabs existed in the workbook when the 'Get Fund Data' button was selected and new reports were generated, those worksheets would be identified and deleted.

Data Management

Archiving the retrieved data in the 'very hidden' worksheets enables the user to delete, modify, and recreate the fund summary reports without necessarily needing to retrieve data from Morningstar.com afresh. Three aspects of data management were important in this regard: creating fund summaries independent of the 'Get Fund Data' action, functionality to delete summary report worksheets, and ability to delete the stored data from the workbook entirely.

The fund creation process was described previously; however, to facilitate the ability to create these reports independently from the 'Get Fund Data' macro, a separate macro was created to create the fund summaries. This pattern of modular code was used fairly extensively throughout the tool to reduce the need for duplicate code and to simplify the code. The 'Fund Summaries' button on the 'Morningstar' tab also calls another macro that is used by the 'Delete Summary Tabs' button, to remove any old worksheets prior to creating new fund worksheets.

Finally, if the user desires to reduce the size of the workbook, or to ensure all archived data has been cleaned from the workbook, the 'Delete Stored Fund Data' button is selected which deletes all fund data from the 'very hidden' fund data storage worksheets.

Difficulties Encountered

Numerous challenges were encountered throughout the development of this tool. Many of these challenges were fairly readily overcome through a quick Google search for code or suggestions on the internet made by others facing similar situations. Two particular challenges during the project related to issues with correct data retrieval and renaming worksheet code names using VBA.

Using the agent class module proved to be a tremendous help in the project. However, a challenge resulted in an issue where the source text was not being updated when new web pages were being opened. Working with Dr. Allen, it was discovered that there was an issue with the agent class when the get text method was being used in a case sensitive way. After a slight modification was made to the agent class, the code ran smoothly.

To be able to delete fund report worksheets, it was necessary to know which worksheets were fund report worksheets. I created a loop that would delete worksheets that had a particular codename beginning with 'fund_' followed by any number, such that the code name might be 'fund_3'. However, I found renaming code names for worksheets using VBA to be a challenge. I found code that could be used to change the code name using VBA, but this code only worked if the VB editor was open. Eventually I found a workaround that I don't really understand, and isn't elegant, but works (Figure 12).

```
'Apparently, if you bypass the first error, it works on second try.  Not needed if VBProject window open
On Error Resume Next
ThisWorkbook.VBProject.VBComponents(Sheets(ticker).codeName).Properties("_CodeName") = sheetCodeName
On Error GoTo 0
On Error Resume Next
ThisWorkbook.VBProject.VBComponents(Sheets(ticker).codeName).Properties("_CodeName") = sheetCodeName
On Error GoTo 0
```

Figure 12: Code to modify a worksheet using VBA if the VB Editor is not open

I feel that this project enabled me to use VBA programming related to many if not most of the topics we discussed in the course including: forms, workbook and worksheet manipulation, web querying, looping and control structures, and ribbon modification. I imagine that if the limits of the tool are pushed, there are likely to be found bugs here and there or functionality that could be improved. However, I feel that the tool is robust enough to be used broadly by the BUSM 418 students in Dr. Sudweeks class.

Assistance

No assistance was provided or obtained from any other person(s) on this project. The agent class code developed by Dr. Allen was used in facilitating data retrieval from Morningstsar.com. At other times, various specific code snippets were found via internet searches and were modified and used in the program.