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IS 520

Final Project Write up

**Executive Summary:**

The GFA equity fund is a undergraduate fund that has over a million dollars in assets. The fund is run by students who analyze hundreds of companies in a semester and present their findings to the class and the professor. Perhaps the hardest part of an equity valuation is forecasting revenues for the company being analyzed. I have created a tool to be used as a sanity check for forecasting revenues.

To begin using the model you must bring it up on a Bloomberg terminal. You select your company, and then refresh the data which copies it as values into a separate sheet so it can be analyzed anywhere. The user can also add economic indicators by filling out a few simple fields in a user form. For example if the user were analyzing Exxon Mobil and there were no indicators for oil prices he or she could look up the ticker for oil prices on Bloomberg and add it into the model. The update data button will also run all the correlations and trend analyses to be used for forecasting.

Once the user selects Run Correlator the model will create a new sheet to be used for analysis. The user can filter the selected economic indicators by how highly correlated they are. They can filter based on an absolute number, for example anything with an  $R^2$  over .5 or take the top number, such as the top 5. This summary also forecasts the selected economic indicator by a set amount each quarter for the next 3 years. The default is .25 standard deviations. This summary will also display a graph that shows that past 2 years total revenue and the 3 forecast years. The user can operate the user form to manipulate the data. They can choose different indicators, change the standard deviation in growth of the indicators, choose whether they want an exponential or linear correlation method. Once the user finds a combination they like they can press the add series button, and then select other combinations to compare. The user can add up to 5 series.

This is no perfect solution for forecasting revenue. It is to see if our forecasts are reasonable. For example if we are forecasting the revenues of Johnson and Johnson, and it has .9 R-squared with GDP growth, which is typically 2-3%, and we have forecasted 15% growth, then there is probably something wrong in our forecast.

**Implementation Documentation:**

**Note: The first few steps of this write-up will only work if the user is connected to a Bloomberg terminal(they can be found in room W237 of the Tanner building, select the Bloomberg user, password is kimsmith). It will be made clear later on in the document where the user should start if her or she is not connected to a Bloomberg terminal.**

The user should start by selecting their company. They put the ticker of their chosen company with the country code in the control sheet as seen below.

	A	B
1	Ticker	XOM US
2	Currency	USD

This will output the name of the company and most recent period ended as seen below

4	Name	EXXON MOBIL CORP
5	Most Recent End Date	09/30/2014

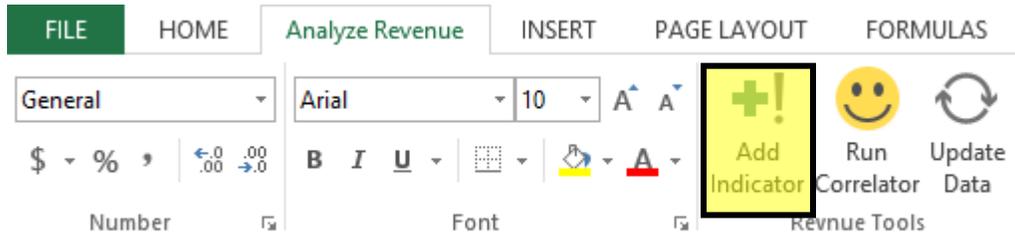
This will update the data sheet, if the user so Desires they can also change what field they want to bring in(E.G. Cogs, Revenue, Net Income) by changing cell C2. It is currently set to Revenue. The is set to bring the most recent data, so the user will never have to change dates.

	A	B	C	D	E	F	G	H
1								
2			Sales rev turn			FRGEGDP INDEX	FRGEIMP INDEX	CPI INDEX
3		x	Revenue_Concurrent	Revenue_Lagged_1Q	Revenue_Lagged_1Y	USA_Nominal_GDP	USA_Housing_Starts	USA_CPI
4		x						
5	-44FQ	09/30/2003			52,860			
6	-43FQ	12/31/2003			55,711			
7	-42FQ	03/31/2004			59,644			
8	-41FQ	06/30/2004		62,706	# N/A Reuesting Data	# N/A Reuesting D:	# N/A Reuesting Dat	# N/A Reuesting Dat
9	-40FQ	09/30/2004	67,809	67,809	# N/A Reuesting Data	# N/A Reuesting D:	# N/A Reuesting Dat	# N/A Reuesting D:
10	-39FQ	12/31/2004	73,830	73,830	# N/A Reuesting Data	# N/A Reuesting D:	# N/A Reuesting Dat	# N/A Reuesting D:
11	-38FQ	03/31/2005	72,237	72,237	# N/A Reuesting Data	# N/A Reuesting D:	# N/A Reuesting Dat	# N/A Reuesting D:
12	-37FQ	06/30/2005	79,107	79,107	# N/A Reuesting Data	# N/A Reuesting D:	# N/A Reuesting Dat	# N/A Reuesting D:
13	-36FQ	09/30/2005	88,571	88,571	# N/A Reuesting Data	# N/A Reuesting D:	# N/A Reuesting Dat	# N/A Reuesting D:
14	-35FQ	12/31/2005	88,298	88,298	# N/A Reuesting Data	# N/A Reuesting D:	# N/A Reuesting Dat	# N/A Reuesting D:
15	-34FQ	03/31/2006	78,653	78,653	# N/A Reuesting Data	# N/A Reuesting D:	# N/A Reuesting Dat	# N/A Reuesting D:
16	-33FQ	06/30/2006	87,813	87,813	# N/A Reuesting Data	# N/A Reuesting D:	# N/A Reuesting Dat	# N/A Reuesting D:
17	-32FQ	09/30/2006	88,504	88,504	# N/A Reuesting Data	# N/A Reuesting D:	# N/A Reuesting Dat	# N/A Reuesting D:
18	-31FQ	12/31/2006	80,116	80,116	# N/A Reuesting Data	# N/A Reuesting D:	# N/A Reuesting Dat	# N/A Reuesting D:
19	-30FQ	03/31/2007	76,890	76,890	# N/A Reuesting Data	# N/A Reuesting D:	# N/A Reuesting Dat	# N/A Reuesting D:
20	-29FQ	06/30/2007	87,249	87,249	# N/A Reuesting Data	# N/A Reuesting D:	# N/A Reuesting Dat	# N/A Reuesting D:
21	-28FQ	09/30/2007	91,160	91,160	# N/A Reuesting Data	# N/A Reuesting D:	# N/A Reuesting Dat	# N/A Reuesting D:
22	-27FQ	12/31/2007	103,301	103,301	# N/A Reuesting Data	# N/A Reuesting D:	# N/A Reuesting Dat	# N/A Reuesting D:
23	-26FQ	03/31/2008	104,791	104,791	# N/A Reuesting Data	# N/A Reuesting D:	# N/A Reuesting Dat	# N/A Reuesting D:
24	-25FQ	06/30/2008	124,238	124,238	# N/A Reuesting Data	# N/A Reuesting D:	# N/A Reuesting Dat	# N/A Reuesting D:
25	-24FQ	09/30/2008	122,758	122,758	# N/A Reuesting Data	# N/A Reuesting D:	# N/A Reuesting Dat	# N/A Reuesting D:
26	-23FQ	12/31/2008	73,284	73,284	# N/A Reuesting Data	# N/A Reuesting D:	# N/A Reuesting Dat	# N/A Reuesting D:
27	-22FQ	03/31/2009	56,222	56,222	# N/A Reuesting Data	# N/A Reuesting D:	# N/A Reuesting Dat	# N/A Reuesting D:
28	-21FQ	06/30/2009	65,951	65,951	# N/A Reuesting Data	# N/A Reuesting D:	# N/A Reuesting Dat	# N/A Reuesting D:
29	-20FQ	09/30/2009	73,285	73,285	# N/A Reuesting Data	# N/A Reuesting D:	# N/A Reuesting Dat	# N/A Reuesting D:
30	-19FQ	12/31/2009	80,106	80,106	# N/A Reuesting Data	# N/A Reuesting D:	# N/A Reuesting Dat	# N/A Reuesting D:
31	-18FQ	03/31/2010	80,222	80,222	# N/A Reuesting Data	# N/A Reuesting D:	# N/A Reuesting Dat	# N/A Reuesting D:
32	-17FQ	06/30/2010	82,747	82,747	# N/A Reuesting Data	# N/A Reuesting D:	# N/A Reuesting Dat	# N/A Reuesting D:
33	-16FQ	09/30/2010	85,181	85,181	# N/A Reuesting Data	# N/A Reuesting D:	# N/A Reuesting Dat	# N/A Reuesting D:
34	-15FQ	12/31/2010	93,428	93,428	# N/A Reuesting Data	# N/A Reuesting D:	# N/A Reuesting Dat	# N/A Reuesting D:
35	-14FQ	03/31/2011	101,335	101,335	# N/A Reuesting Data	# N/A Reuesting D:	# N/A Reuesting Dat	# N/A Reuesting D:
36	-13FQ	06/30/2011	112,781	112,781	# N/A Reuesting Data	# N/A Reuesting D:	# N/A Reuesting Dat	# N/A Reuesting D:
37	-12FQ	09/30/2011	111,991	111,991	111,991	509,913	148,262	224.7
38	-11FQ	12/31/2011	107,419	107,419	107,419	511,035	148,444	226.1
39	-10FQ	03/31/2012	110,696	110,696	110,696	512,189	145,904	227.0
40	-9FQ	06/30/2012	104,718	104,718	104,718	510,962	146,556	228.2
41	-8FQ	09/30/2012	102,852	102,852	102,852	512,101	145,701	228.0

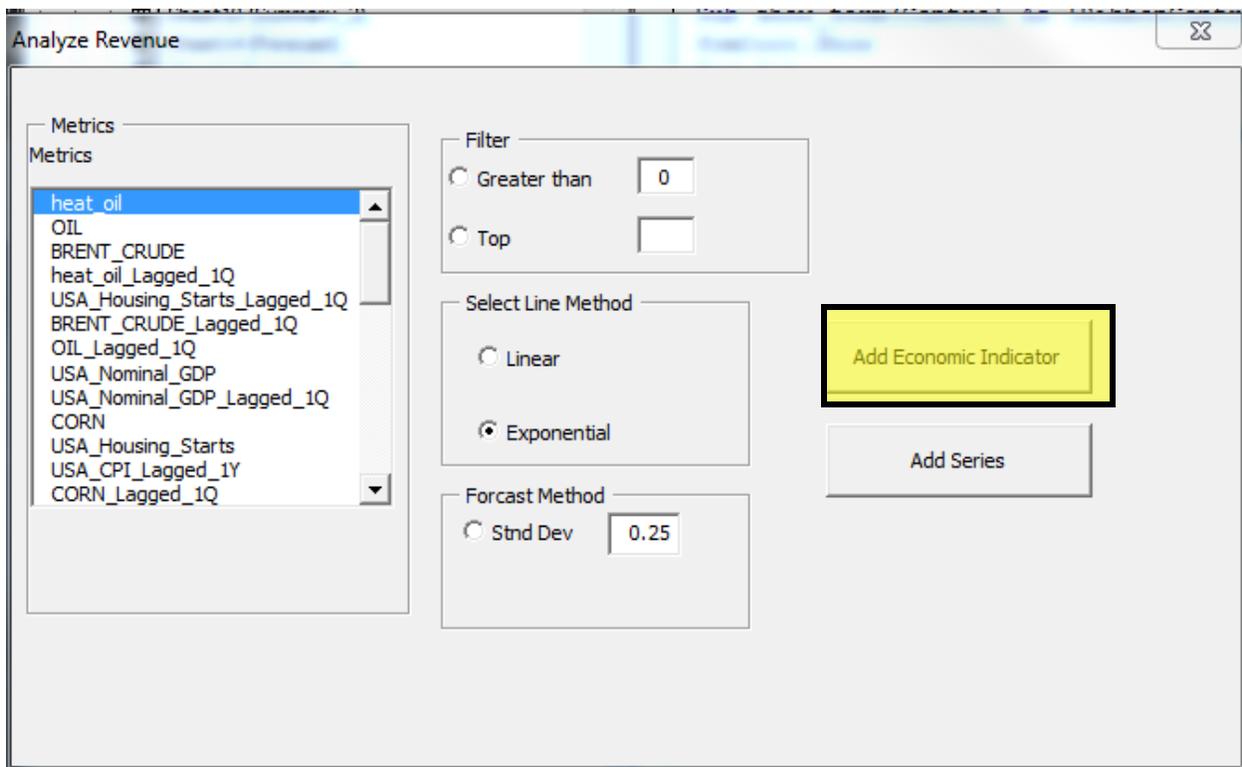
As you can see the data takes a few seconds to come in, but it is relatively quick

The user may want to add an economic indicator. For example they may be analyzing Lumber Liquidators and want to bring in Lumber Prices. They can do this in 2 ways. They can select the Add Indicator button on the Analyze Revenue tab or select the Add Economic Indicator button on the Correlation user form. (Note: there are already about 15 indicators in the model)

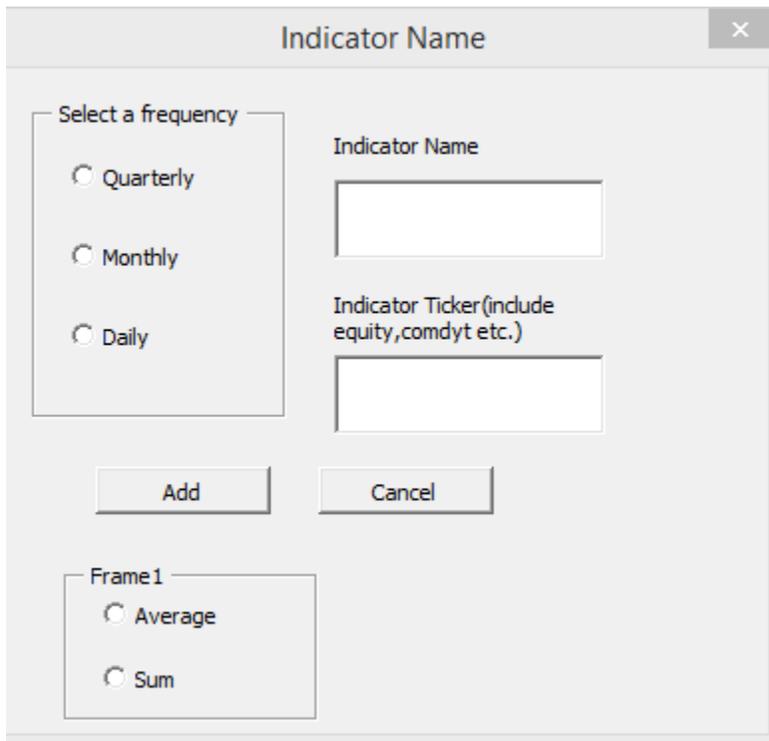
1.



2.



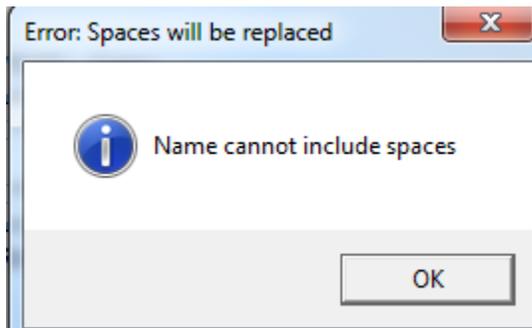
Doing either of these will display the Add User form. (See Below)



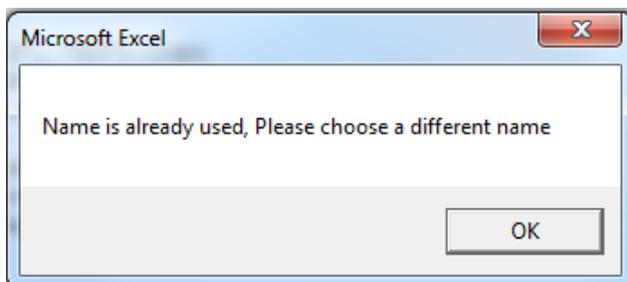
The dialog box is titled "Indicator Name" and has a close button (X) in the top right corner. It contains the following elements:

- A group box titled "Select a frequency" with three radio buttons: "Quarterly", "Monthly", and "Daily".
- A text input field labeled "Indicator Name".
- A text input field labeled "Indicator Ticker (include equity, comdyt etc.)".
- Two buttons: "Add" and "Cancel".
- A group box titled "Frame1" with two radio buttons: "Average" and "Sum".

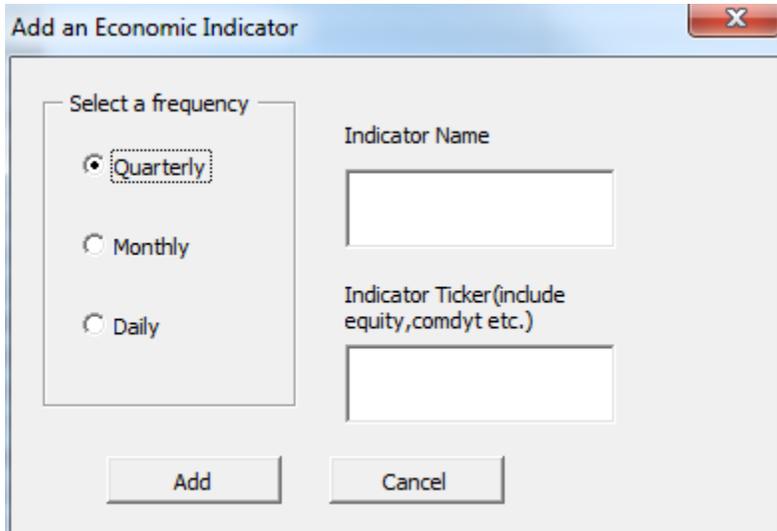
The user would select the name of the indicator, this will be used as a named range later so spaces are not allowed. An error message will be displayed if the user attempts to do this. It will then replace the spaces with underscores.



It also may be that a name that is already in use. An error will be displayed if the user does this.



The user finds the name of the ticker for the indicator from Bloomberg, using the lumber example the user would input "LB1 comdty" in the indicator ticker field. The same check is in place to make sure there are no duplicate names. The user must also select a frequency . Lumber is something that changes Daily, whereas something like housing starts is monthly and something like GDP is quarterly. There is also different ways to aggregate your data. For example if you wanted to average price of Lumber you would select average and daily, but if you wanted the total number of housing starts you would select sum and monthly. Since there is no aggregation necessary when choosing quarterly, this option to aggregate is hidden if quarterly is chose as seen below. It is hidden by simply changing the height of the user form.



Once the user selects add it will go to the data sheet and add the indicator on the far right, it also used the information entered to produce a very complicated Bloomberg add-in Excel function. This will generate the necessary data for the past 40 quarters for selected indicator. (Note: The user can run this user form while not connected to Bloomberg and it will insert the function, however it will not return any data)

Once the all the desired indicators and dependent variable(in this case revenue) is selected the user should press the update data button on the analyze revenue tab. This will run the update\_data\_1 sub procedure located in module 4.



The update\_data\_1 sub runs the following sub procedures, unless otherwise specified they are all found in module 4.

- Range Value data
  - Copies and pastes the data tab into the Rangevalue tab as values so the user can use the data without access to a Bloomberg terminal
- Clear names
  - Loops through all the names in the Rangevalue sheet and deletes them
- Creates names
  - for each the 40 quarters worth of data in each column, the names is based upon what is found in row 3 of each column, on the rangevalue sheet.
- GetCorrelations
  - As you can see in the data sheet the revenue column is repeated 3 times but it is offset by 1 quarter and 1 year. This is so that leading indicators can be determined. For example by moving it up one column, the current quarter's revenue will be correlated on last quarter's indicator. Last quarter's revenue will be correlated on the penultimate quarter's revenue and so on. This is very useful because we can observe the most recent indicator to forecast next quarter's revenue. They are displayed in the Linear\_corr tab.

	Revenue_Concurrent
heat_oil	0.84
OIL	0.81
BRENT_CRUDE	0.80
heat_oil_Lagged_1Q	0.64
USA_Housing_Starts_Lagged_1Q	0.58
BRENT_CRUDE_Lagged_1Q	0.57
OIL_Lagged_1Q	0.53
USA_Nominal_GDP	0.53

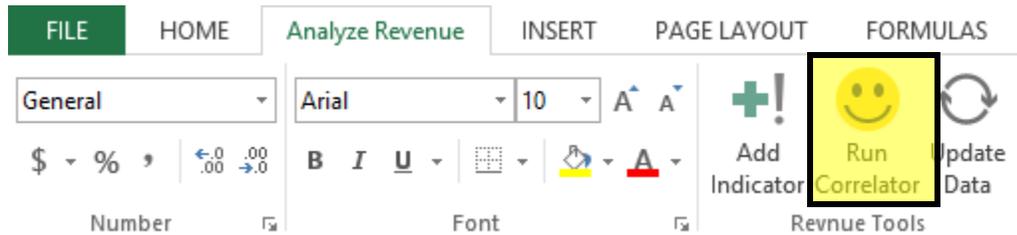
- The sub puts the indicators on the Y axis and then puts the 3 revenue measures on the x-axis and runs correlations using the named ranges created in the create names sub
- This results in a 3 column by number of indicators table. It is then put into one column and sorted in descending order.
  - This is done by a sub called single\_column\_list(found in module 2)
- GetCorrealtions\_Exp
  - Does the exact same thing as the GetCorrelations sub but correlates it on the natural log of the dependent variable to generate the exponential r-squared. It's as if you put the 2 data sets on a scatter plat inserted an exponential trendline and inserted the r-squared value. They are displayed in the Exponential\_Corr tab.
- Get\_Linear (found in module 2)
  - Generates the variables necessary for the linear trendline, the intercept and the slope, it follows the same process of first creating a 3 column table, and then is put into one column but it not sorted.

- It also uses the `single_column_list` sub but the `sort_list` variable is set to false in the preceding subs, so it is not sorted. They are displayed in the Linear tab
- `Get_Exponential` (found in module 2)
  - Does the same thing as `get Linear` but calculates the constant and exponent value used in the exponential trendline. They are displayed in the Exponential tab.

	A	B	C
1		Constants	Exponents
2	USA_Nominal_GDP	504	0.0104
3	USA_Housing_Starts	17867	0.0117
4	USA_CPI	23491	0.0063
5	OIL	46974	0.0080
6	GOLD	70953	0.0002
7	BRENT_CRUDE	53301	0.0062
8	CORN	66666	0.0007
9	heat_oil	51265	0.0024

The user can pick up from here if they are not connected to a Bloomberg terminal.

Now comes the fun part. Analyzing the data. This process is started by pressing the run correlator button on the analyze revenue ribbon.



It shows the Correlation user Form as seen below. There is a lot that goes in to creating this form.

Along with this form, every time the sub is run, it will create a new sheet, this is so the user can do separate analyses on separate dependent variables if they so desire. Another reason I chose to have a new sheet created every time is because many students will be using, and there is a lot of potential to have it messed up.



- It then runs the add series sub procedure
  - Essentially this adds all the necessary formulas on the summary sheet
    - It was very tricky due to all the quotation marks necessary in the formulas
    - You will notice the formulas are very robust, this took a lot of time to figure out how to do this
  - I chose to have the add formulas instead of hard values so the user can continue to manipulate the data after the form has and been closed.
  - It adds the lookup formulas for the Line methods and R-squared values, based on whether exponential or linear method is selected
  - It calculates the St. Deviation of Growth in the selected indicator
  - it inserts the St. Deviation you wish to grow the indicators by each quarter, default is .25

There is a lot of text here so let's break it up with a meme



- next it inserts the values for all the indicators over the past 16 quarters
  - it then grows them by your standard deviation multiplied by the growth selected by the user(.25 is the default)
- Next it uses the best fit lines(either linear or exponential) and uses them to forecast revenue in the forecast quarters.
- Finally it summarizes the revenue by year, and creates a graph
- **Finally to make it look professional, all the cells are formatted properly.**

Phew!!

Now let's look at the user form again to look at some of the other functionality

The user can filter metrics by values greater than a certain number, or by selecting a top desired number. The user simply chooses one of the options (Greater than, or Top) and then enters a value in the text box and presses enter. This will run either the GetMetrics or GetMetricsTop sub.

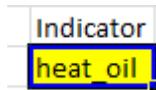
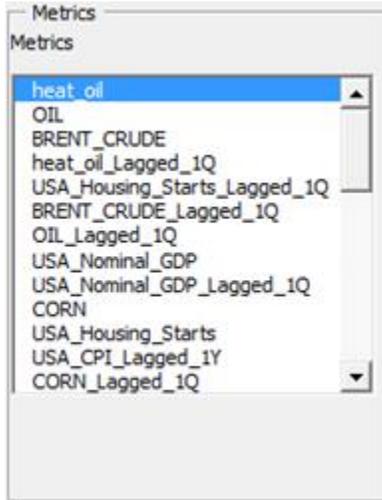
The user can also select linear or exponential line method. This will change the value in column B. Since all the formulas look up of this value, everything will change.

	A	B
1		
2		
3		
4		Type
5		Exponential
6		

The user can also select different Std Dev, which will change the amount by which the X's (independent or indicators) grow.

St_Dev
0.25

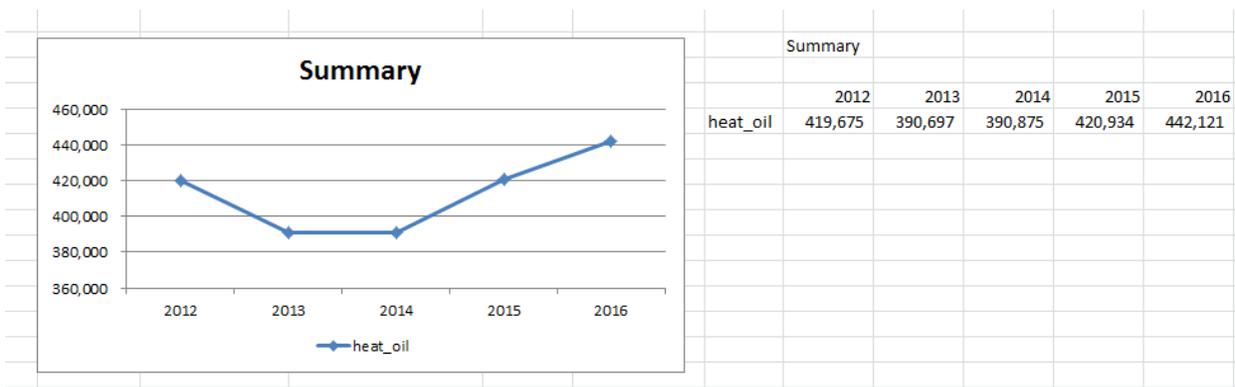
The user can also select a different Metric, also referred to as indicator throughout this document. When a user double clicks the indicator will change, and so will all the results.



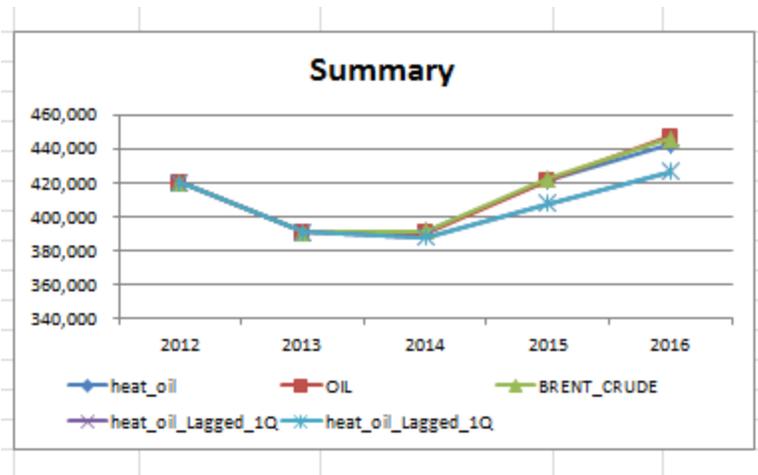
This is a little ticker, because each indicator will have a different formula depending on whether or not it is a lagged variable(used in leading indicators). Therefore a double click on the metrics list runs the replaceforecast sub. This sub just replaces the formula for the line that is forecasting the revenues.

2014	2015	2015	2015	2015	2016	2016	2016	2016
12/31/2014	3/31/2015	6/30/2015	9/30/2015	12/31/2015	3/31/2016	6/30/2016	9/30/2016	12/31/2016
102,196.7	103,377.2	104,591.3	105,840.3	107,125.3	108,447.8	109,809.0	111,210.4	112,653.4

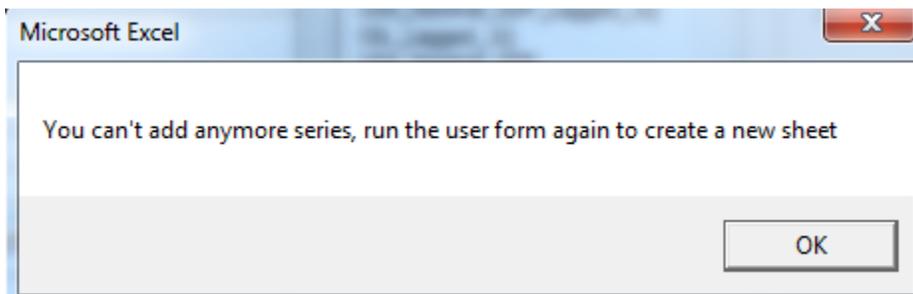
Any time any of these are changed it will also change the Summary Revenue, which is where the graph gets its data from therefore it will change too.



Once the user is satisfied with their choice they can select the add Series button, this will copy all the formulas, and the user can then select different mixes of methods and indicators to see how they compare.



The maximum that can be shown on one graph is 5 series, after that the user will receive an error message.



### **Discussion of learning:**

I learned a lot from this project, I learned how many objects there are in VBA. I have many loops where I loop through controls within the user form to see what the values are. At first I tried using a bunch of if statements to determine this, but the loops worked rather well.

I also had a lot of difficulty creating the summary sheet. It may not be the most efficient code. I have lots of offsets, and end(xldowns)'s when there was probably an easier way. Learning how to get the exact cell I wanted regardless of what was already on the worksheet was difficult.

I had extreme difficulty with looping through all the variables in a sensible manner to get the correlations, and formula for the trendline. I struggled with many different ways to this. It was especially difficult because I had to figure out a way so that the user form, and summary sheets could work easily with the data as well.

Probably the hardest part was getting all the formulas, to work properly. I often have 4 or 5 lines just to determine the formula for one cell. Luckily the address property came in handy. There are also lots of quotes in the formulas themselves. I worked around this by setting a variable, "Qu" or "Quote" to chr(34) which is the quotation mark. Then anytime I needed to use it I just wrote in Qu.

I wanted to work in a way where the user could choose between a Bloomberg forecast of the indicators or the standard deviation growth method. It was just too hard to figure out, because Bloomberg is inconsistent with their forecasts. Some are forecasted out for 3 years, some only for a quarter into the future, and the time periods would've been difficult to match up as well. I asked my finance professor for help on the Bloomberg end and we simply couldn't figure it out.

After spending about 30-40 hours on this project I would say I learned a lot. The things I learned the most about were, user forms, loops and the Formula and FormulaArray properties.

I did not receive any assistance on this project.