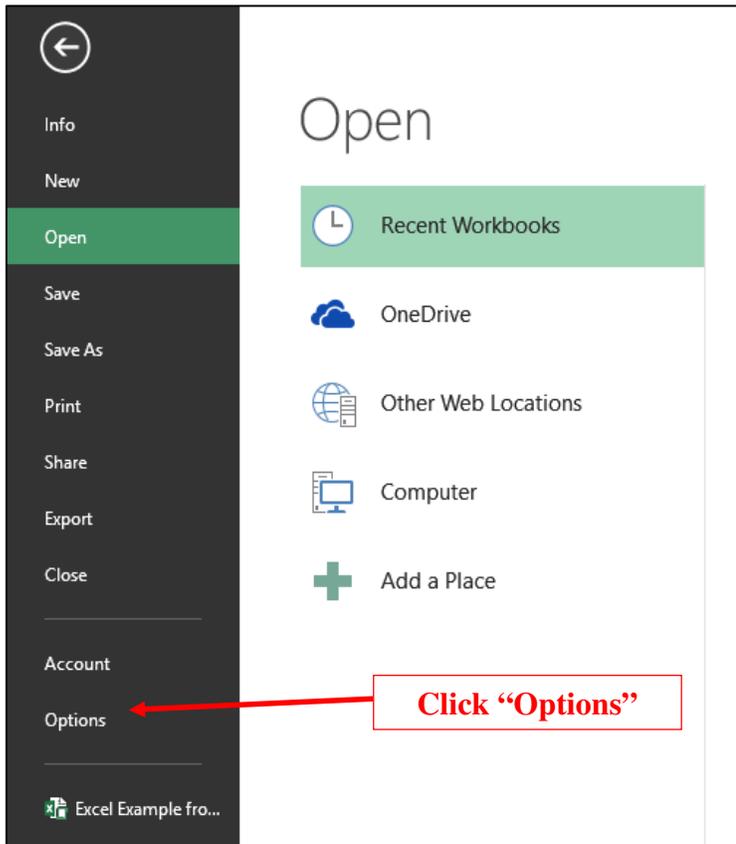
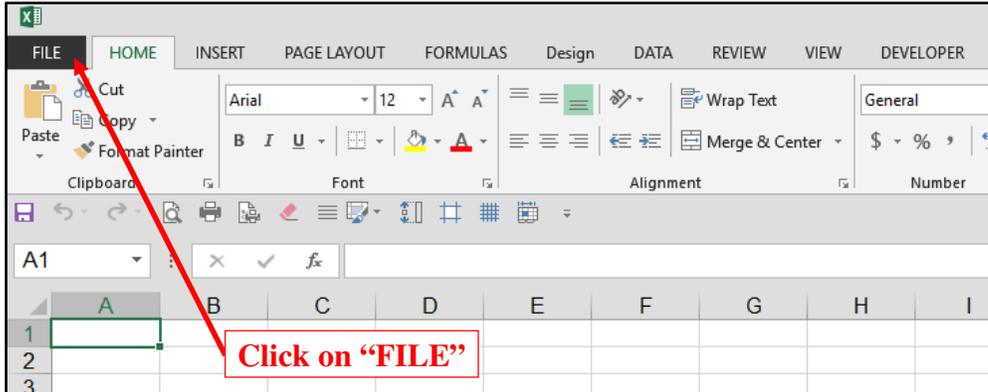


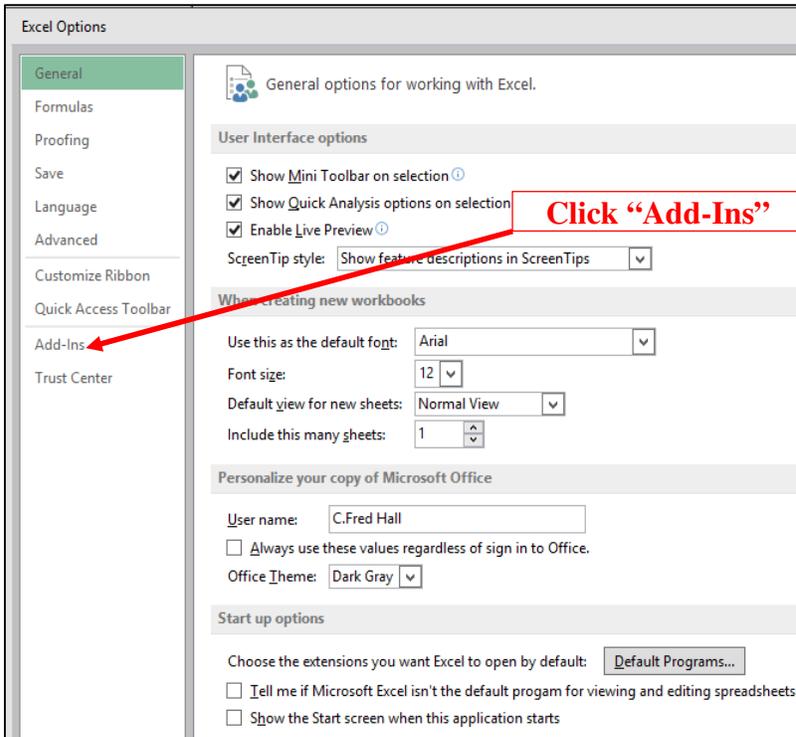
## INSTALLING EXCEL'S REGRESSION UTILITY

Your computer and Excel do not come pre-installed with the Excel regression utility. You must perform the following steps with each computer to enable using regression. You only need to do this once for each computer.

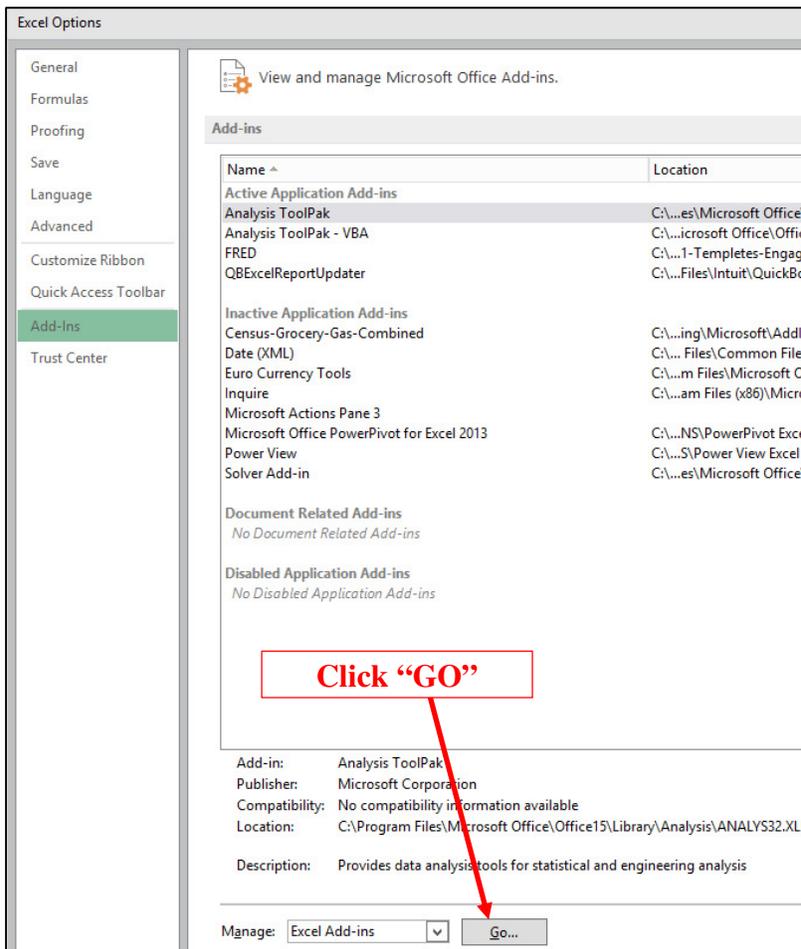
First start by clicking the “File” menu in the upper left corner of the Excel worksheet.



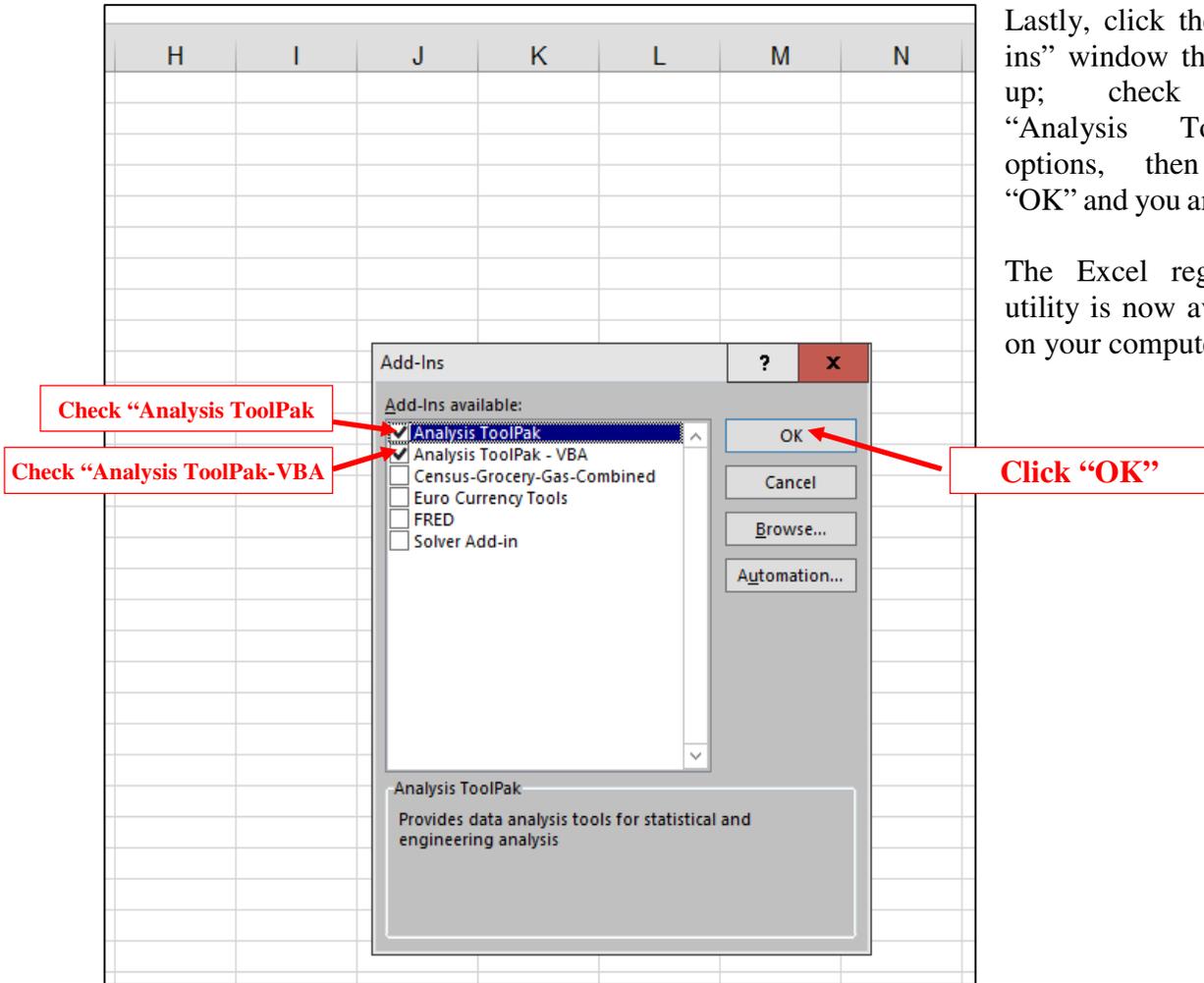
Next click the “Options” link in the lower left corner of the screen.



Next, click the “Add-ins” link in the lower left corner of the Options window.



Next, click “Go...” at the bottom of the Add-ins window.

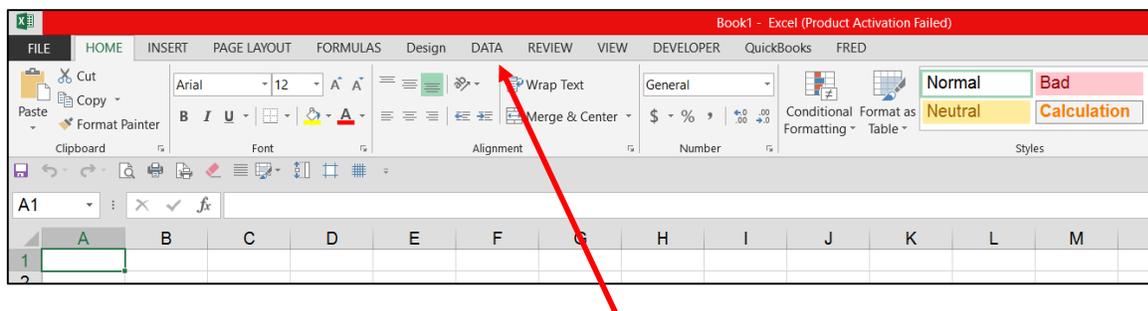


Lastly, click the “add-ins” window that pops up; check both “Analysis ToolPak” options, then click “OK” and you are done.

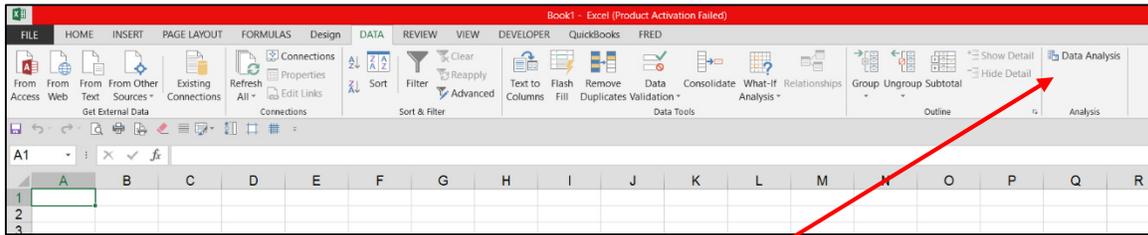
The Excel regression utility is now available on your computer.

## USING EXCEL’S REGRESSION UTILITY

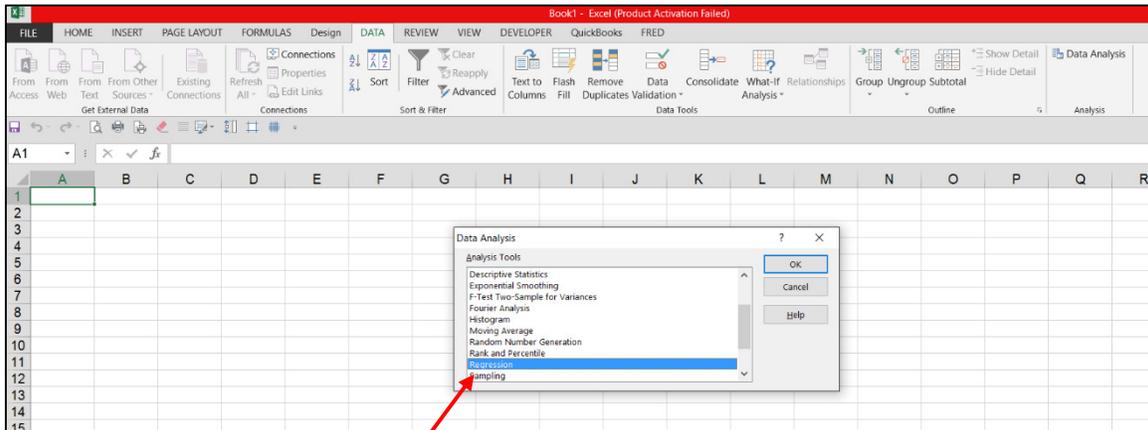
You will now find a new Excel menu option on the menu ribbon entitled “DATA”.



Click the “Data” menu title and the following menu will appear.



To access the Regression Utility, click “Data Analysis.”



Scroll down and click “Regression.”

The Regression Utility Window will appear as shown below:

In “Input **Y** Range” box enter the range of Multiplier data. (In this example - \$B\$5:\$B\$19)

In “Input **X** Range” box enter the range of SDE% data. (In this example - \$C\$5:\$C\$19)

In the “Output Range” box enter where you want to start printing all the Regression data.

(In this example \$E\$1. Caution - the Regression printout will delete out any data in the range \$E\$1:\$M\$40, that is 9 columns wide and 40-60+ rows deep depending on how many comparables you are regressing. Make sure there is nothing important in this area.)

Revenue Multipliers	SDE%
0.45	7.2%
0.33	6.4%
0.48	7.9%
0.51	8.5%
0.55	8.4%
0.56	9.2%
0.58	15.1%
0.45	12.2%
0.49	13.5%
0.59	18.1%
0.62	20.0%
0.63	19.0%
0.65	18.0%
0.63	22.0%
0.71	25.0%

Check the “Residuals” box and, if you wish to see a graph of the data, check the “Line Fit Plots” box.

NOTES:

In the above example, SDE% is referred to as the independent variable, or Input X (the predictor), and, Revenue Multiplier is the dependent variable, or Input Y. In single independent-variable regressions (as opposed to multiple-variable regressions), the two columns of data in the example above do not have to be next to each other or, even on the same worksheet, but, they must have exactly the same number of rows (in this example 15 rows).

There cannot be any blank cells in the two ranges of data that you have selected. You will get an error message from Excel. If a particular cell is blank, (for example, say, the third revenue multiplier was blank instead of 0.48), then either remove the transaction from the list (preferred option) or enter a zero in the cell.

The regression printout will look like this:

E	F	G	H	I	J	K	L	M
SUMMARY OUTPUT								
<i>Regression Statistics</i>								
Multiple R	0.844							
R Square	0.712							
Adjusted R Square	0.689							
Standard Error	0.055							
Observations	15							
<i>ANOVA</i>								
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>			
Regression	1	0.095615	0.095615	32.07032	7.76E-05			
Residual	13	0.038758	0.002981					
Total	14	0.134373						
	<i>Coefficient</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	0.356	0.036763	9.69453	2.58E-07	0.276975	0.435816	0.276975	0.435816
X Variable 1	1.370	0.241937	5.663067	7.76E-05	0.847431	1.892776	0.847431	1.892776
<i>RESIDUAL OUTPUT</i>								
	<i>Observation</i>	<i>Predicted</i>	<i>Residuals</i>					
	1	0.455043	-0.005044					
	2	0.444082	-0.114083					
	3	0.464634	0.015366					
	4	0.472854	0.037146					
	5	0.471484	0.078516					
	6	0.482445	0.077555					
	7	0.563281	0.016719					
	8	0.523548	-0.07355					
	9	0.541359	-0.05136					
	10	0.604384	-0.01438					
	11	0.630416	-0.11042					
	12	0.616715	0.018285					
	13	0.603014	0.048986					
	14	0.657818	-0.02782					
	15	0.698921	0.011079					

The Regression Equation for the straight line is in the standard form of

$$Y = mx + b$$

Or in our case:

Multiplier = **m** times SDE% + **b**, or carried farther:

$$\text{Multiplier} = 1.370 \times \text{SDE\%} + 0.356$$

#### RESIDUALS AND USING STANDARD ERROR TO IDENTIFY OUTLIERS

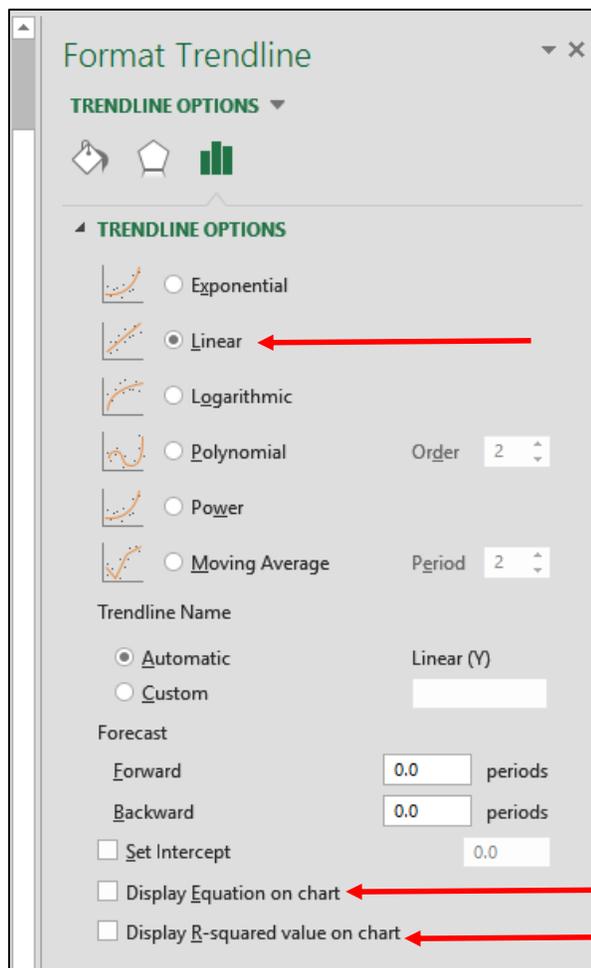
“Residuals” is the term Excel uses to describe the difference between a transaction’s actual multiplier versus the multiplier that was predicted by the above linear equation. For example, Observation #1 from the table on page 5 had an actual revenue multiplier of 0.45 and an SDE% of 7.2%. If we plug 7.2% into the above regression equation we get:

$$1.37 \times 0.072 + 0.356 = 0.455$$

0.455 is the predicted multiplier for #1, which is shown on the “*Predicted*” column of the Residual Output table. The transaction had an actual multiplier of 0.45. Therefore, the difference, or Residual, is -0.005 ( $0.45 - 0.455$ ), which is shown on the “*Residuals*” column.

At the top of the Regression Output you will find the Standard Error calculation, which was 0.055 in this example. This is a similar statistic to Standard Deviation. Theoretically, 16% of the transactions in the sample will have an actual multiplier that is more than plus or minus one Standard Error away from its predicted multiplier. For example, observation #2 in the Residual Output table above, the actual multiplier was 0.33 (from the table on Page 5) and the predicted multiplier using the regression equation was 0.444. The difference, or Residual, was  $-0.114$  ( $0.33 - 0.444$ ). The residual is greater than minus one Standard Error of 0.55 and, therefore, should probably be considered an outlier.

Once you remove the outliers from your sample (there were four in the example above), you would do a second regression with the smaller filtered sample and use that regression equation to predict your subject’s multipliers.



#### LINE FIT PLOT – THE REGRESSION CHART

The “Line-Plot” chart that also appears with the Regression Output can be formatted with colors, borders, titles, etc. Just right-hand click on the chart and follow the menus. You can also add the Regression Trend Line to the chart by right-clicking on any of the blue dots on the chart and selecting “Add Trend Line.” When you click on this button you will get the window on the left.

Select “Linear” (the default).

If you wish to have the regression linear equation printed on the chart, check the “Display Equation on Chart” box at the bottom of the screen and, if you wish to see the R-squared value on the chart, check the “Display R-Squared on the Chart” box.

Good luck. If you get lost, don’t hesitate to call me:

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