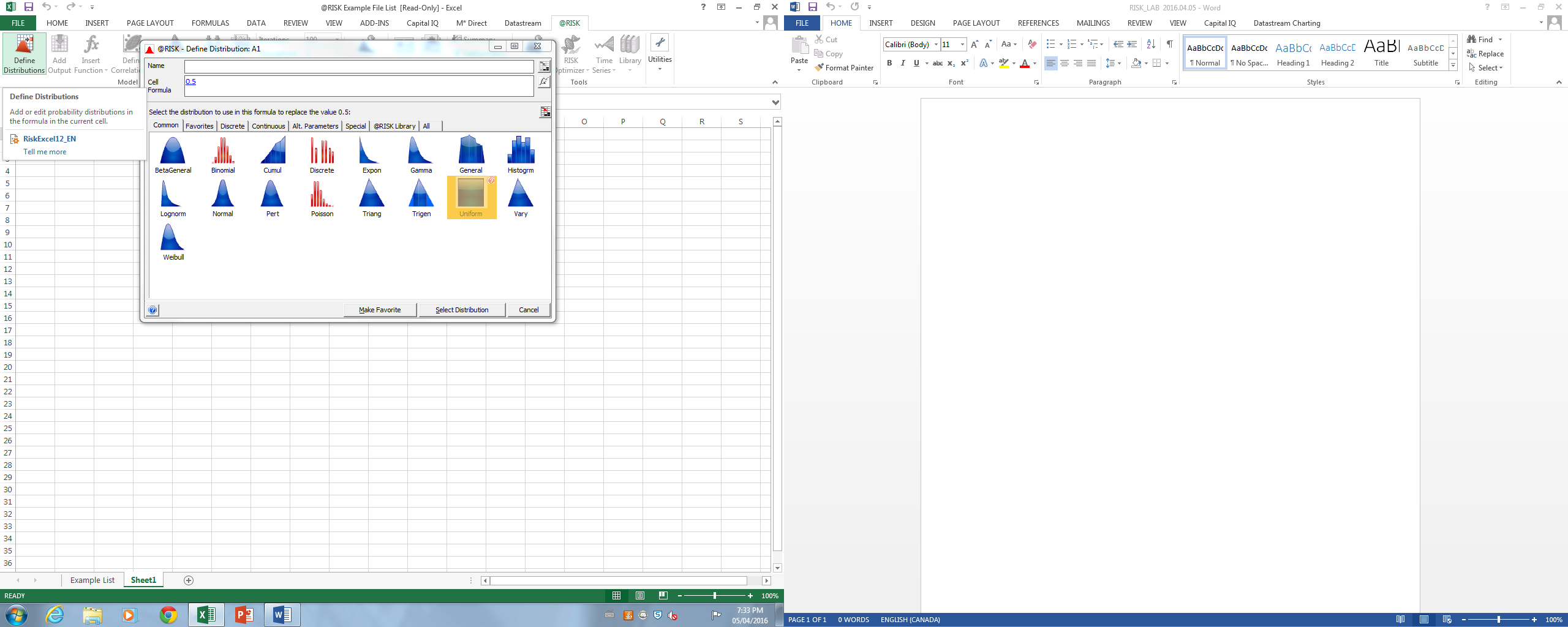
COPULAS

# Definind variables for copulas

Select cell, click Define Distribution



Equivalent of typing this formula in the cell:

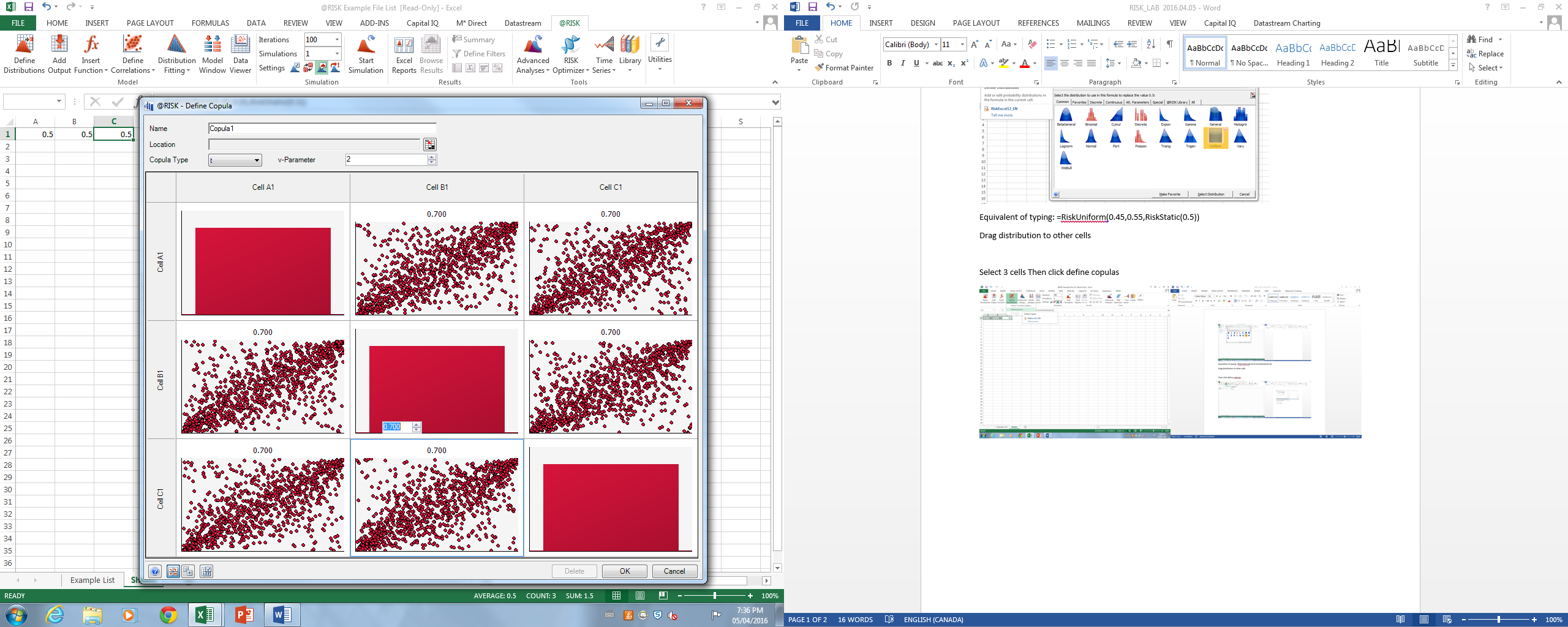
=RiskUniform(0.45,0.55,RiskStatic(0.5))

Drag distribution to other cells

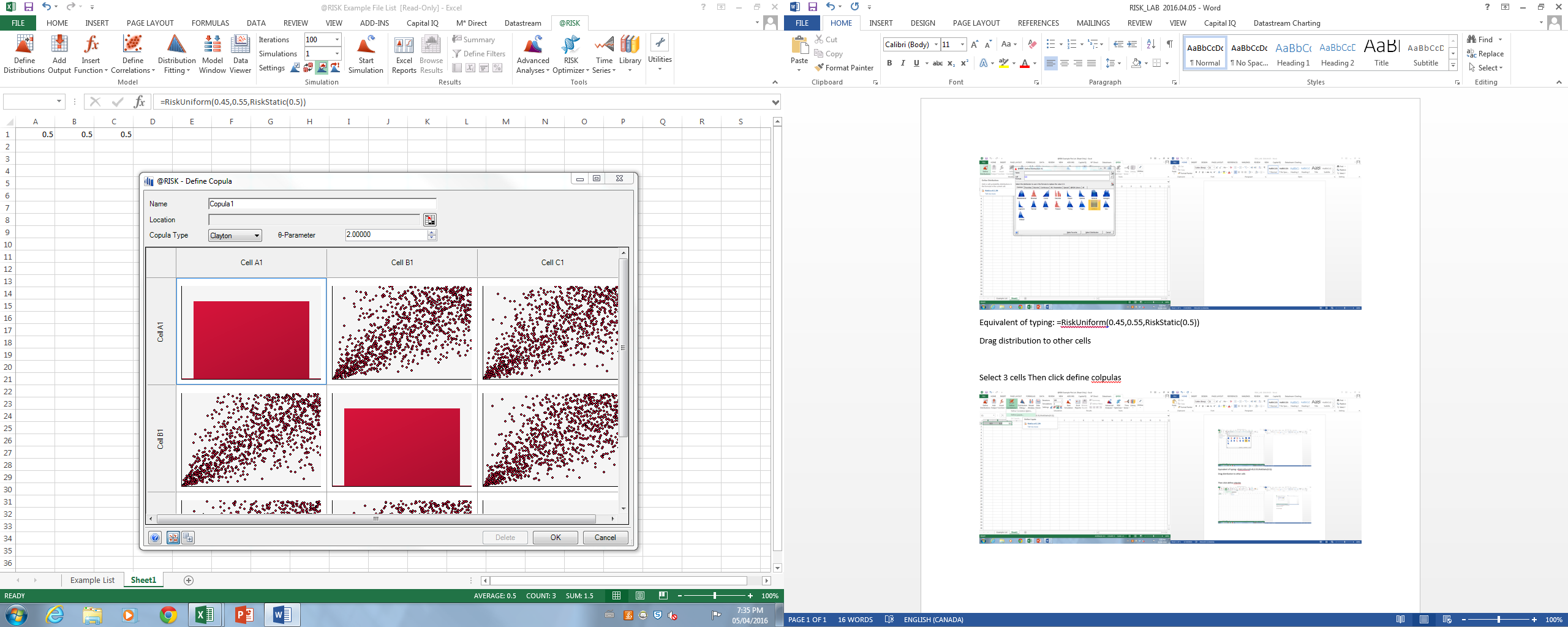
Select the 3 cells containing the variables, then click define copulas

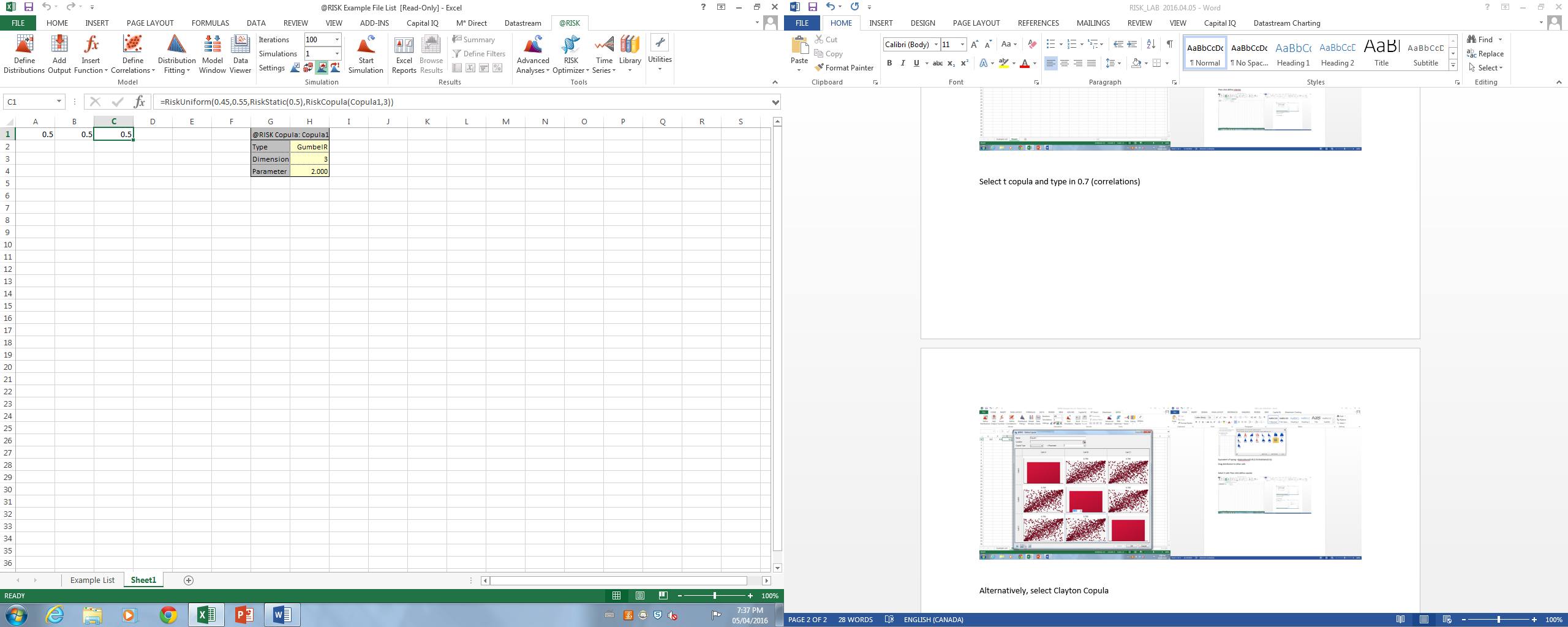


Select t copula and type in 0.7 (correlations)



Alternatively, select Clayton Copula





Then when you click on the cells, they are linked with the copula by their formula

A1: =RiskUniform(0.45,0.55,RiskStatic(0.5),RiskCopula(Copula1,1))

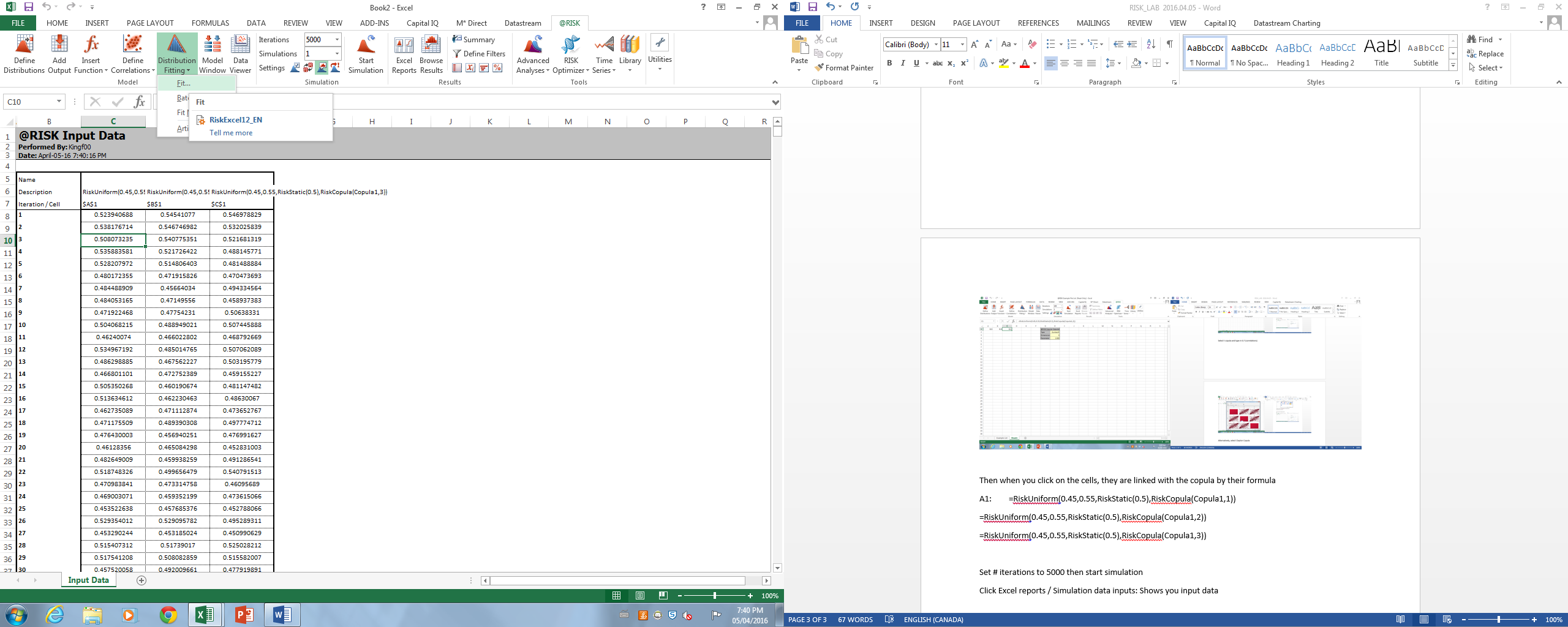
=RiskUniform(0.45,0.55,RiskStatic(0.5),RiskCopula(Copula1,2))

=RiskUniform(0.45,0.55,RiskStatic(0.5),RiskCopula(Copula1,3))

Set # iterations to 5000 then start simulation

# Reverse engineer correlations if given results

Click Excel reports / Simulation data inputs: Shows you input data

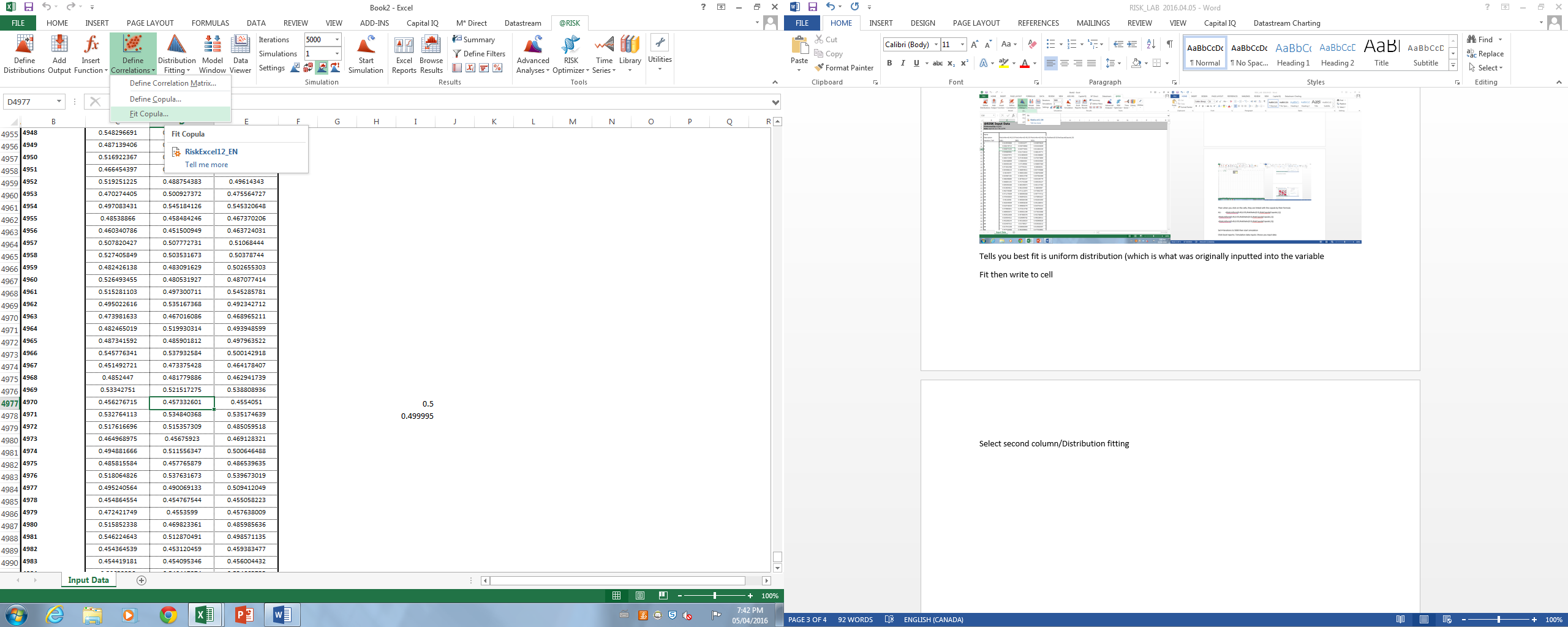


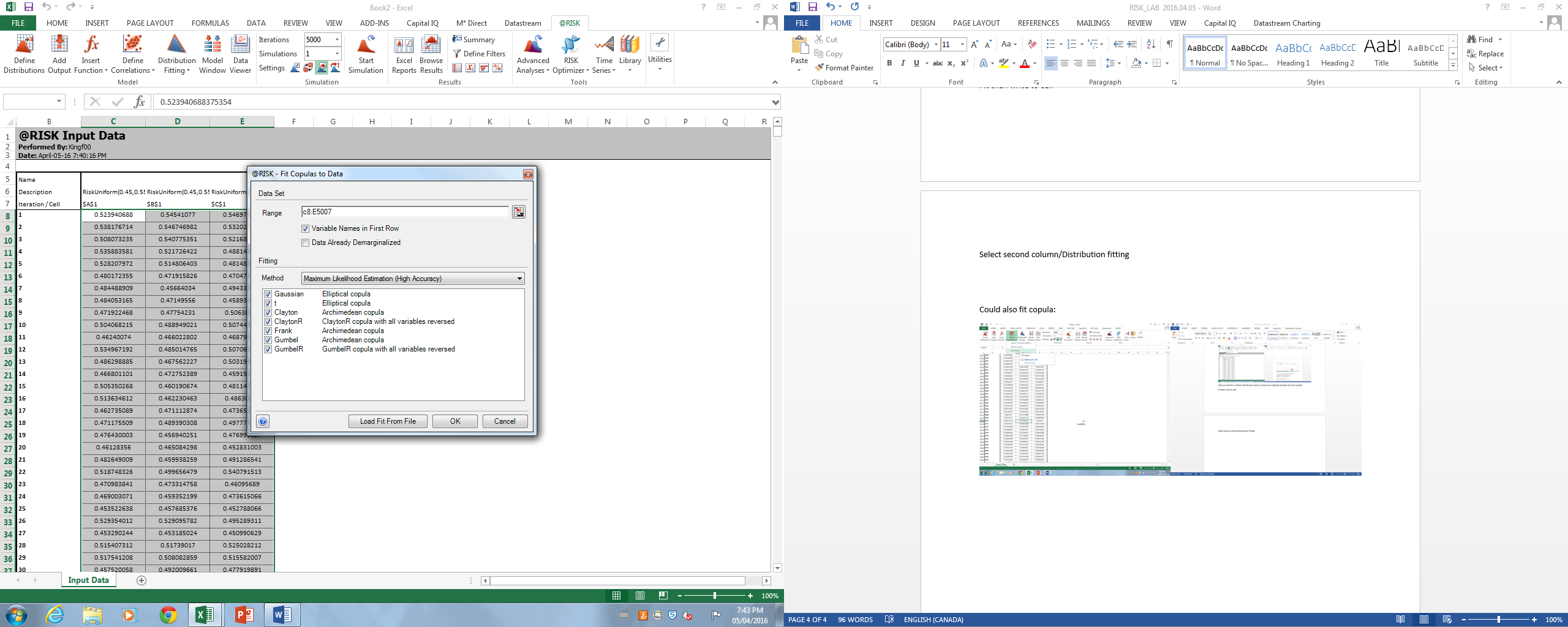
Tells you best fit is uniform distribution (which is what was originally inputted into the variable

Fit then write to cell

Select second column/Distribution fitting

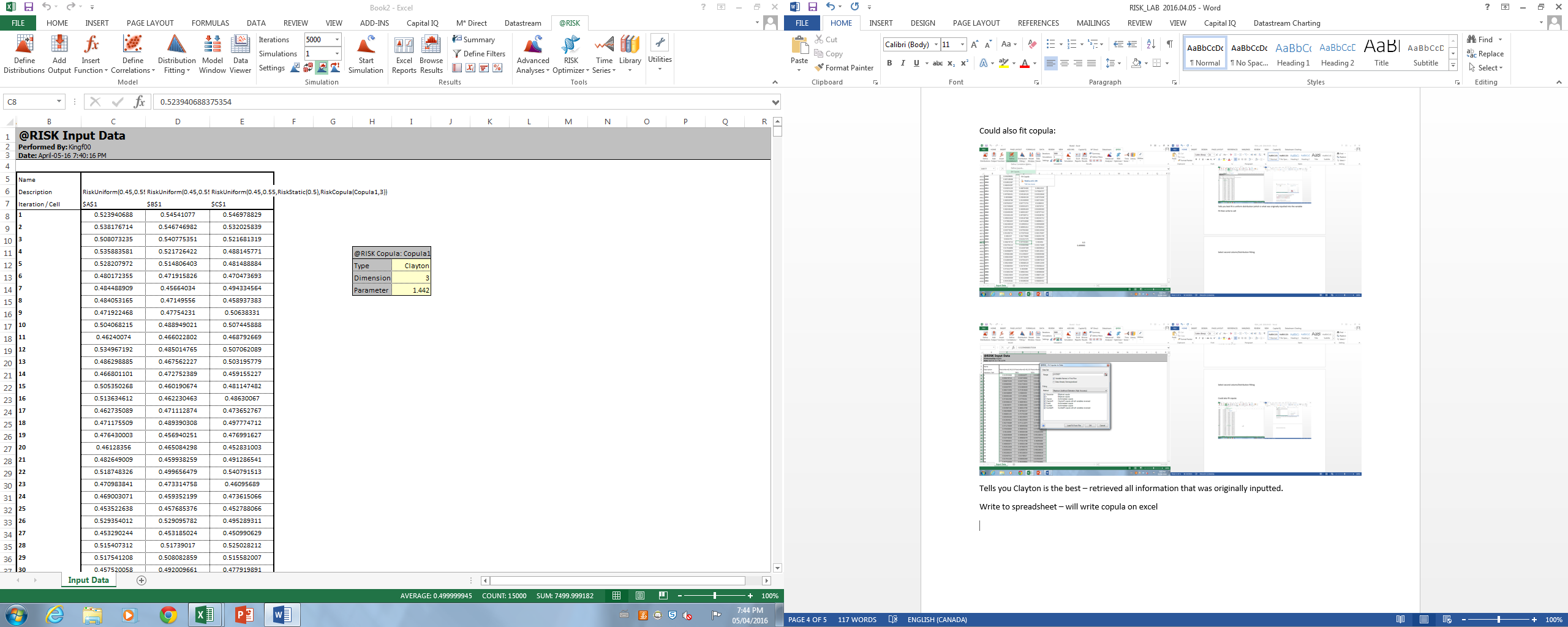
Could also fit copula:





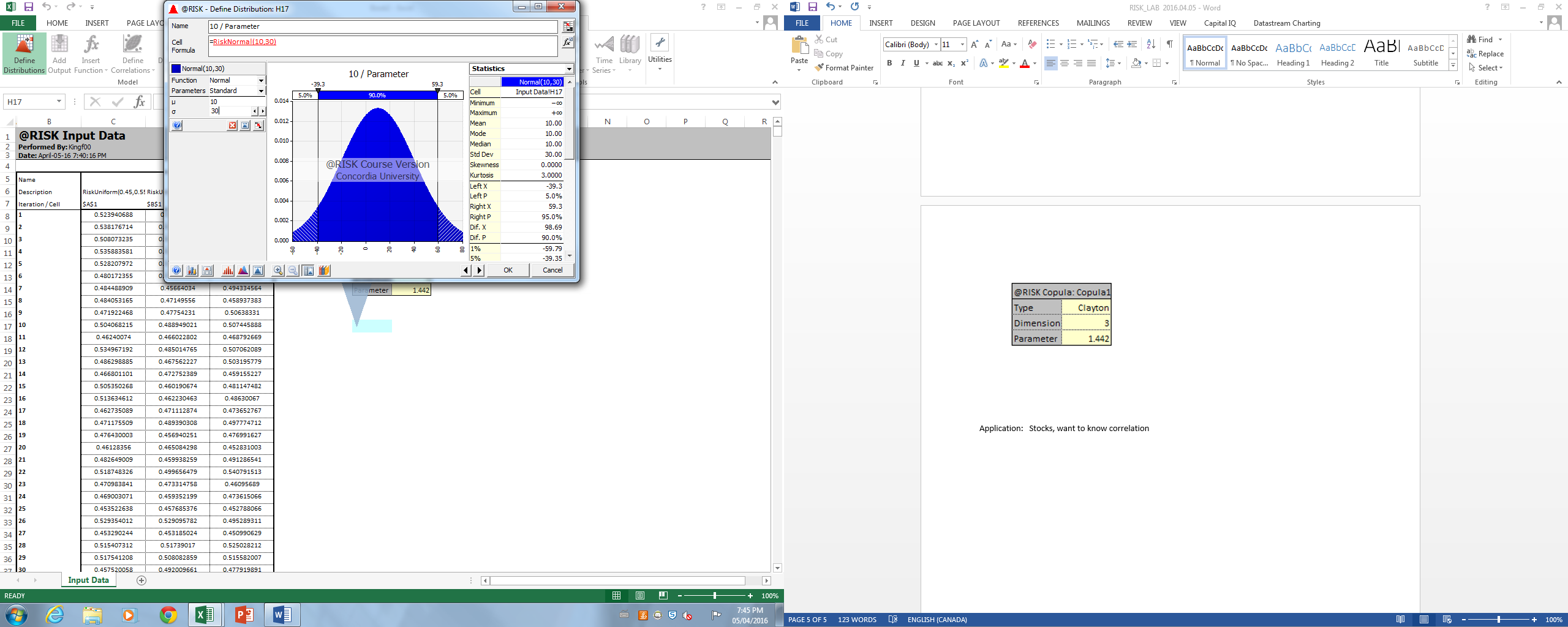
Tells you Clayton is the best – retrieved all information that was originally inputted.

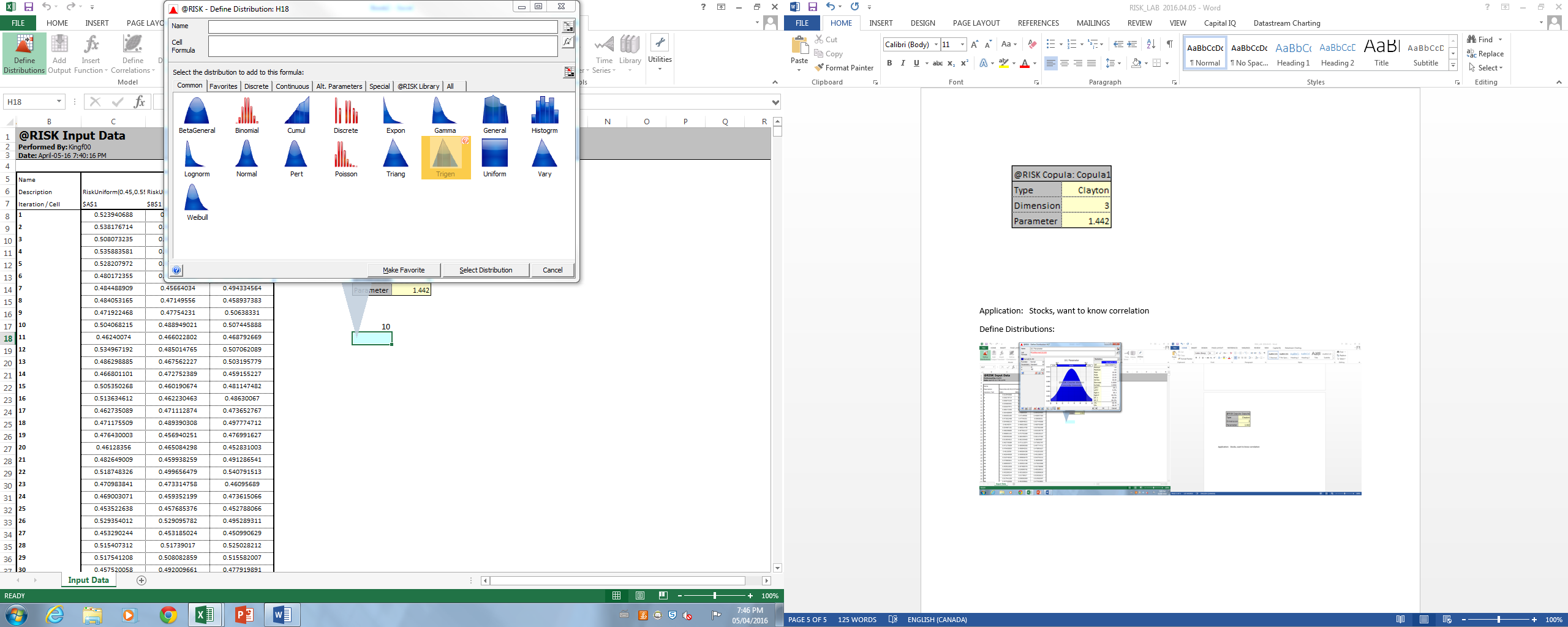
Write to spreadsheet – will write copula on excel

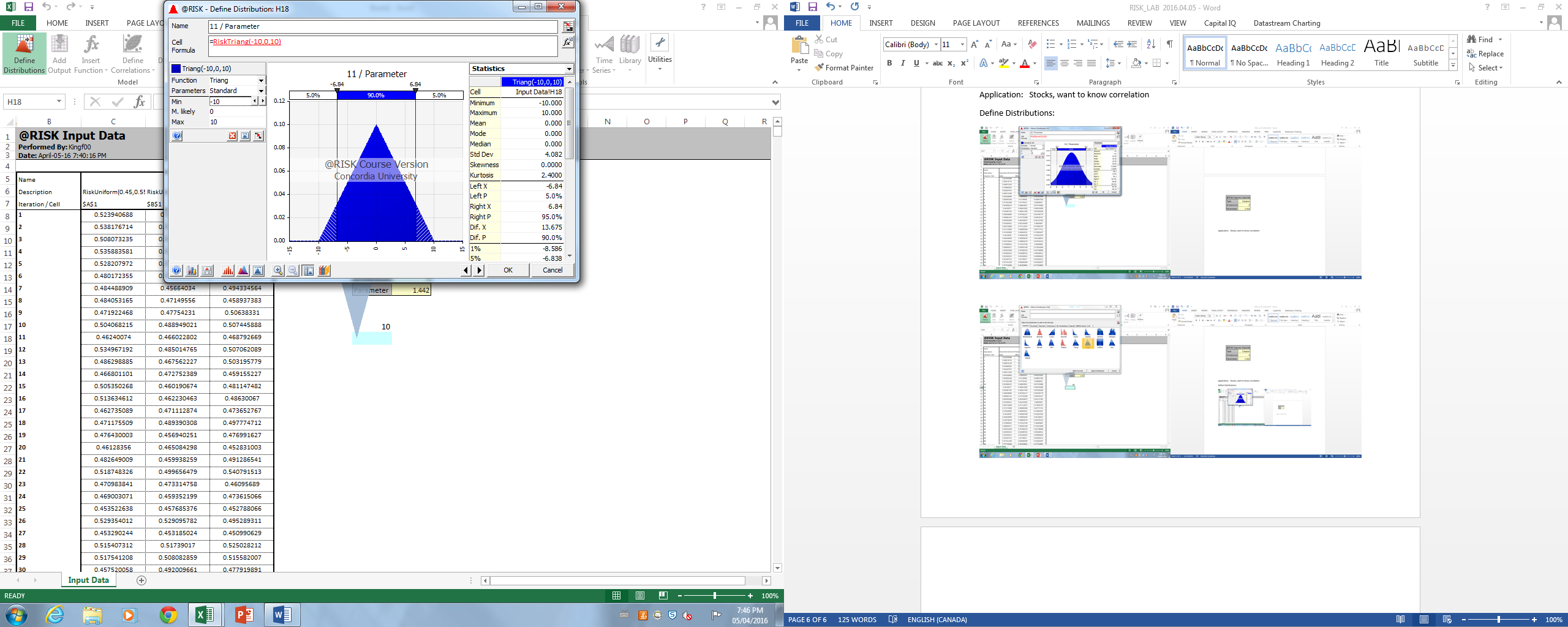


Application: Stocks, want to know correlation

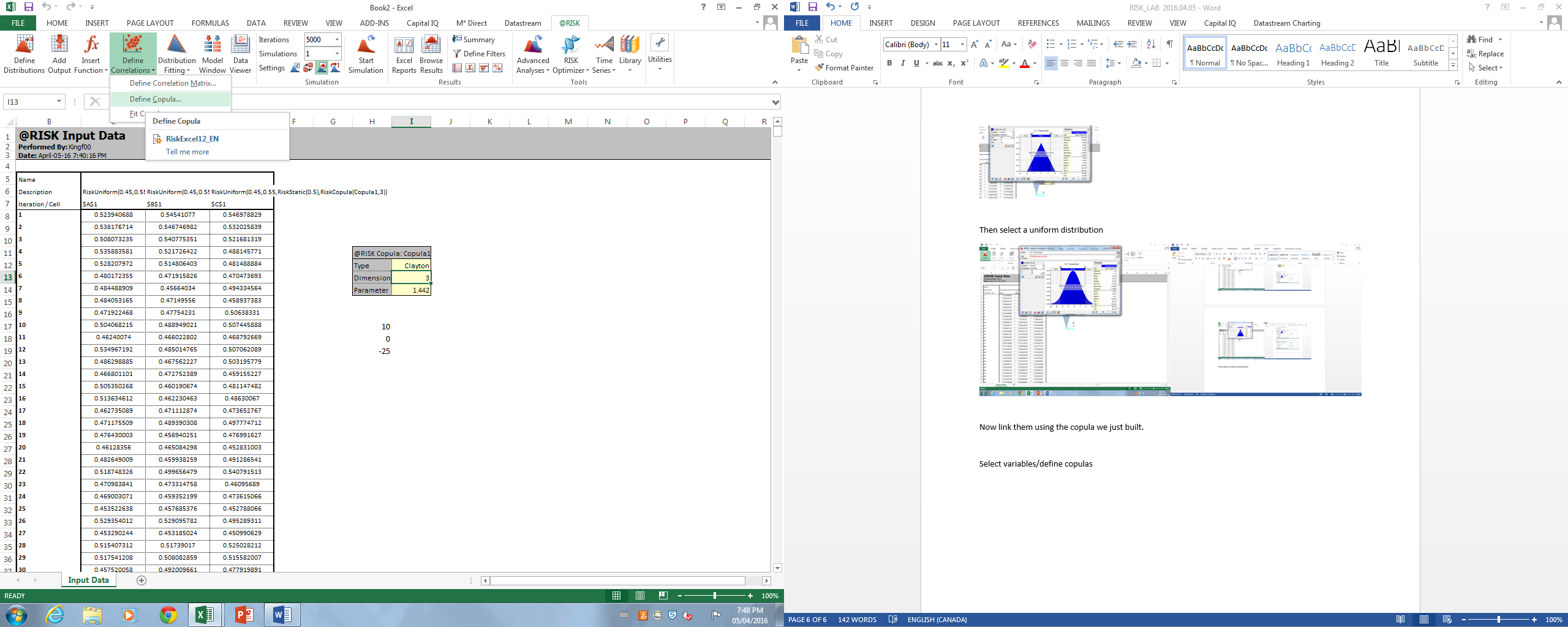
Define Distributions:





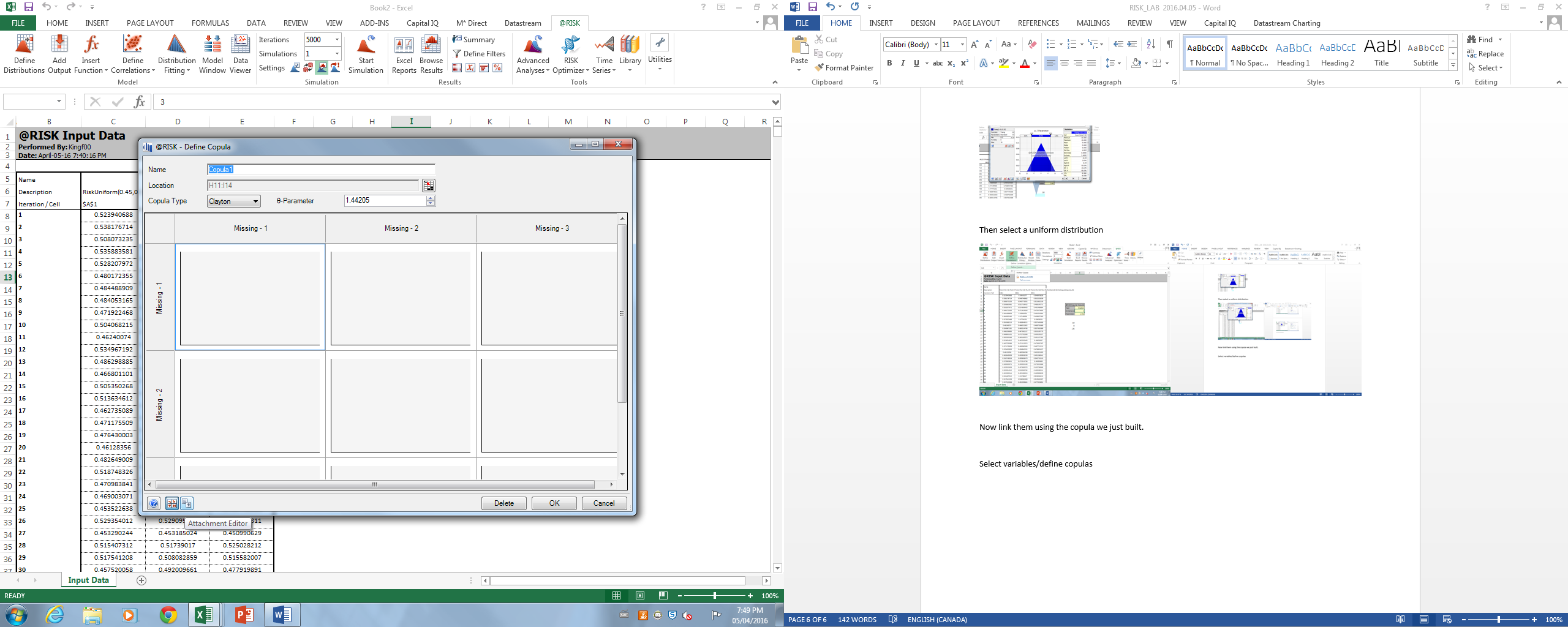


Then select a uniform distribution

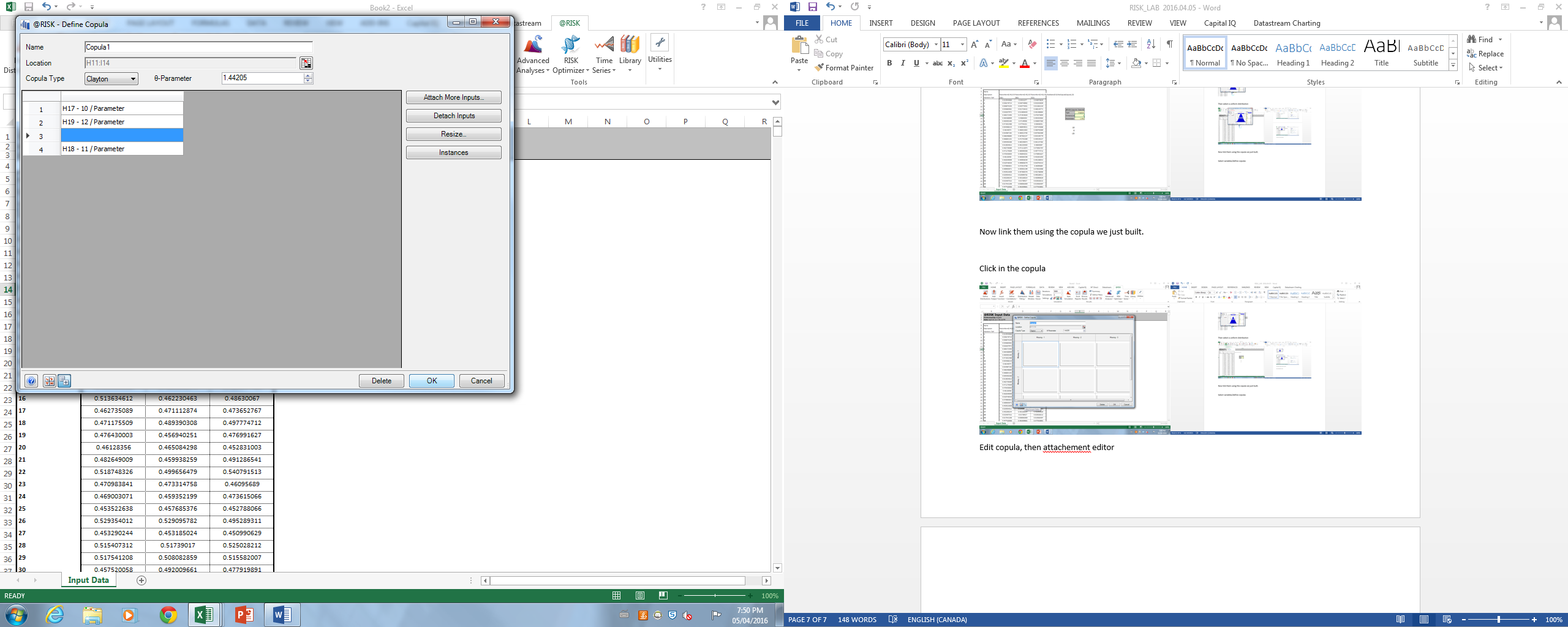


Now link them using the copula we just built.

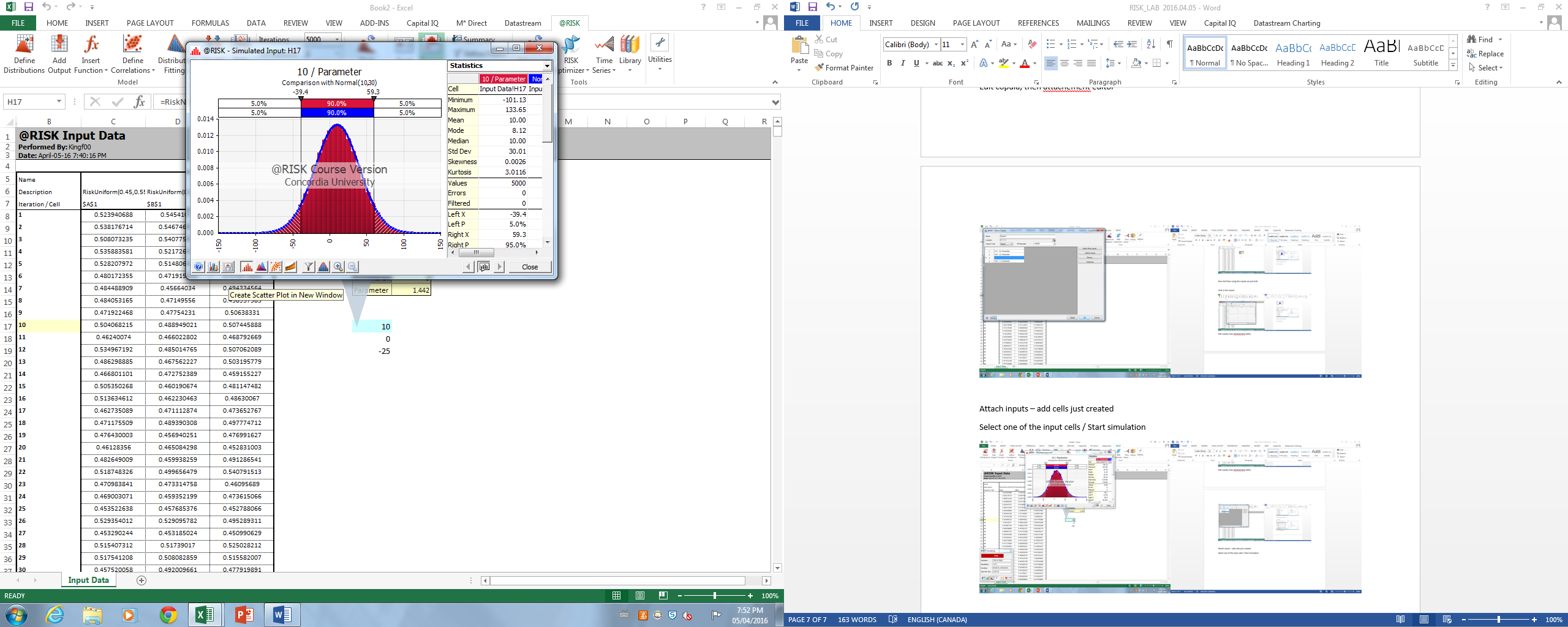
Click in the copula



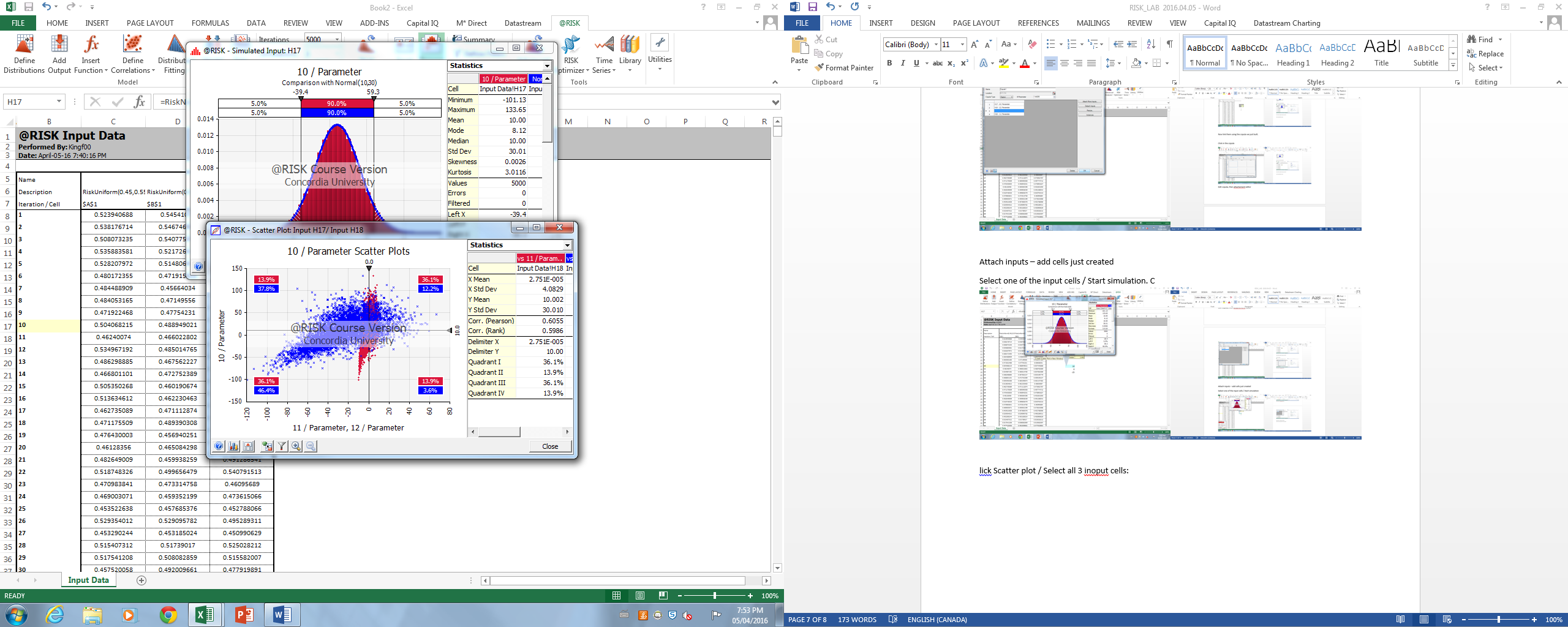
Edit copula, then attachement editor



Attach inputs – add cells just created

Select one of the input cells / Start simulation. 

lick Scatter plot / Select all 3 inoput cells:



Have 3 stocks.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Stock 1 | Stock 2 | Stock 3 |
| Mean Growth Rate | 12% | 18% | 25% |
| Volatility | 25% | 35% | 50% |
| Initial Stock Price | $ 20 | $ 30 | $ 40 |
| # Shares Bought | 1000 | 750 | 500 |
|  |  |  |  |
|  |  |  |  |
| Initial Portfolio Value | $ 62,500 |  |  |

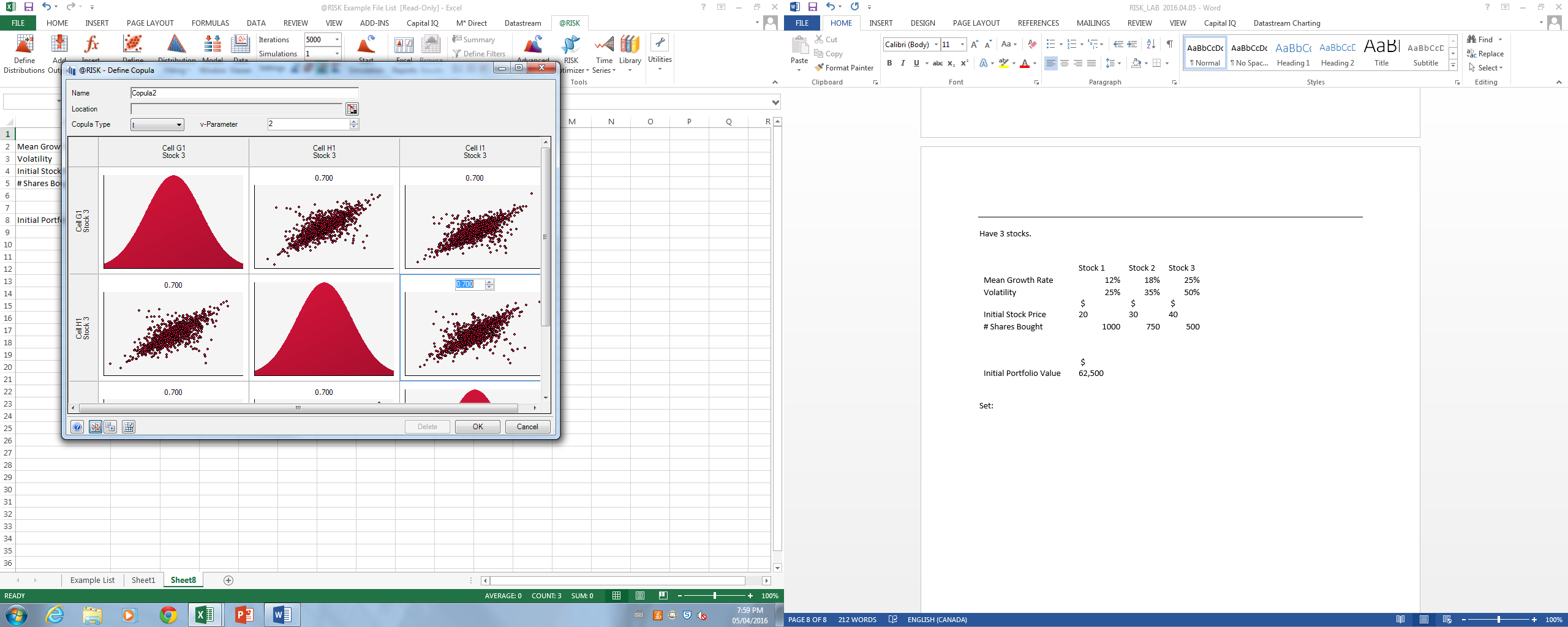
Set:

G1=RiskNormal(0,1)

H1= RiskNormal(0,1)

I1= RiskNormal(0,1)

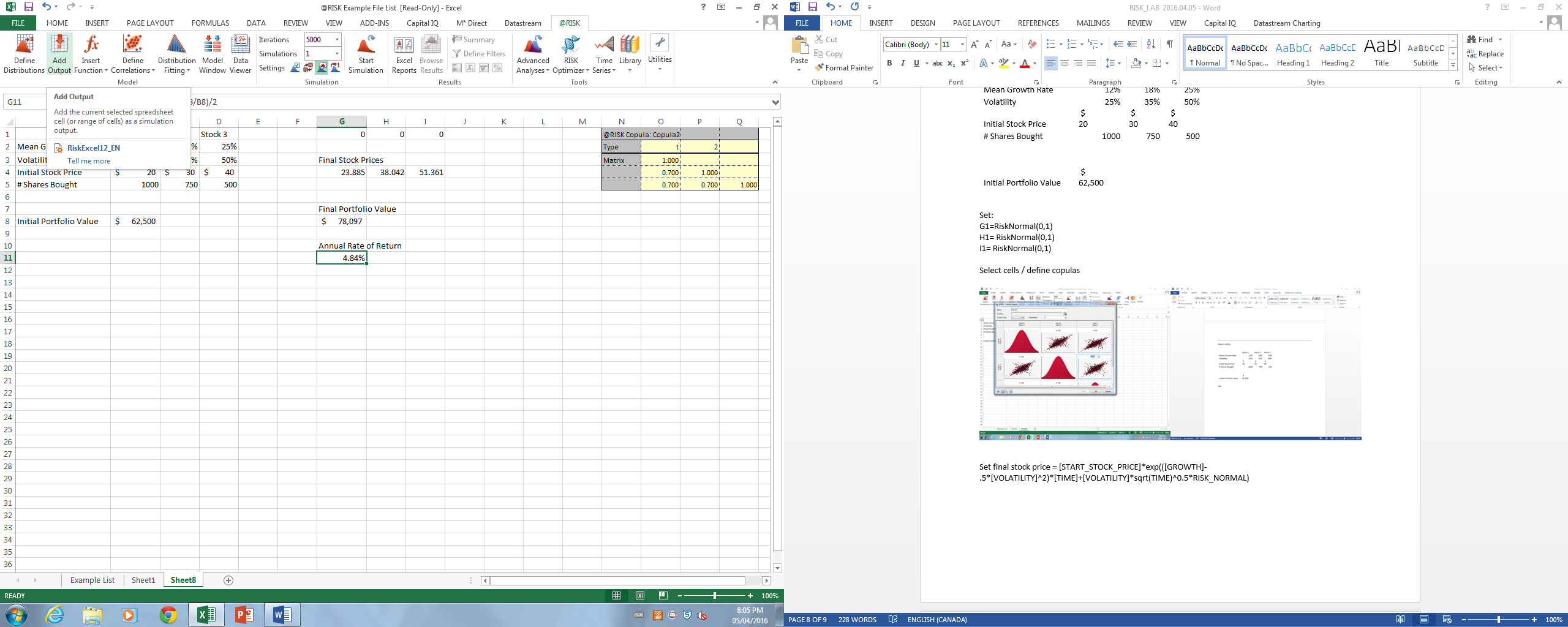
Select cells / define copulas



Set final stock price = [START\_STOCK\_PRICE]\*exp(([GROWTH]-.5\*[VOLATILITY]^2)\*[TIME]+[VOLATILITY]\*sqrt(TIME)^0.5\*RISK\_NORMAL)

Calculate ARR

Add output to the cell containing ARR:



Start simulation

What is the probability to make a loss?

Probability of a loss

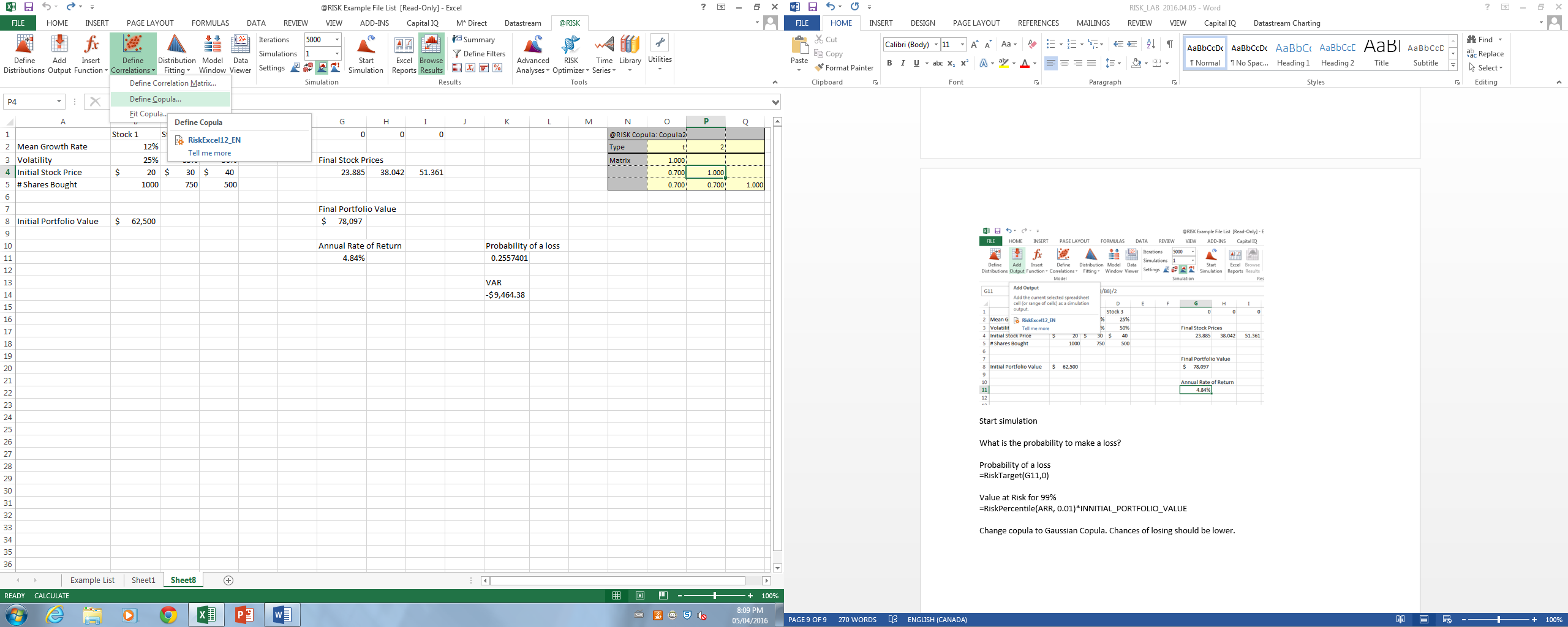
=RiskTarget(G11,0)

Value at Risk for 99%

=RiskPercentile(ARR, 0.01)\*INNITIAL\_PORTFOLIO\_VALUE

Change copula to Gaussian Copula. Chances of losing should be lower.

Click in the copula, define copula



Change to Gaussian Copula

T and Gaussian copulas should be fairly similar in terms of probability of default. But looking at the tails (99% VAR), should be more of a difference; Gaussian copula is more conservative (but t coppula is a more accurate description of stock market.