*Prof. Evgeniya Duzhak*

Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ECO 140

GSI\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Fall 2020

**Homework 1**

**1*.*** Let A,B,C be annual returns on Apple INC, government Bonds and CityGroup INC stocks respectively. The table below describes the probability distributions for these stock returns based on the state of the economy.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | ***A*** | ***p(A)*** | ***B*** | ***P(B)*** | ***C*** | ***P(C)*** |
| *Recession* | 0.04 | 0.2 | 0.09 | 0.2 | -0.2 | 0.2 |
| *Normal* | 0.22 | 0.6 | 0.1 | 0.6 | 0.1 | 0.6 |
| *Expansion* | 0.3 | 0.2 | 0.11 | 0.2 | 0.4 | 0.2 |

1. Are A, B and C random variables?

Yes, No (circle the correct answer)

1. Is it discrete or continuous probability distribution? (circle the correct answer)
2. For each random variable, compute the expected value, variance, standard deviation. **Comment** on the results for **each** stock. (**Show** your work. )

E[*A*] =

Var[*A*] =

sd[*A*] =

E[*B*] =

Var[*B*] =

sd[*B*] =

E[*C*] =

Var[*C*] =

sd[*C*] =

Comment:

1. Suppose you have a portfolio consisting of $200 in Apple INC stocks, $200 in government bonds and $100 in CitiGroup INC stocks. Calculate the expected annual return (note that the answer should be in % units):
2. Given that *A, B* and *C* are independent, calculate the variance and standard deviation of the **returns** to that portfolio.(*Hint*: Calculate Var(0.4*A*+0.4*B*+0.2*C*))

**2*.***  The file **gold\_sp500.xls** contains a table with weekly data for the prices of gold and the S&P 500 index for the period 1985 to 2020.

1. What is the type of this data set?
2. Make a time series plot of the data. Make sure it looks professional. Include labels, title, units of measurement. Interpret the plot. Attach the printout.
3. Pick a stock of a company that has a ticker that starts with the same letter as your last name (e.g. Duzhak = DIS for Walt Disney company). Find and download weekly data for your stock over the same period as the rest of the observations in your data set. Add it to the existing data file.
4. Using this data, estimate the mean, standard deviation, skewness, and kurtosis of gold, S&P 500 and your stock prices for ***each*** decade. Put your answers into the “Answer\_Table” table below. **Interpret the results**.

Create a new data series, *ln*(*Gold), ln(S&P500) and ln(Your stock*), by taking a natural log of every observation. Then make the new series, measuring a percentage change in the price of a commodity/security. For example, the percentage change in the price of gold for a given month can be found according to the formula Δ*ln*(*Gold*) = *ln*(Goldt) – *ln*(Goldt-1). Call these variables *rGold, rSP500, r”Your stock name”.*

1. Find the mean, standard deviation, skewness, and kurtosis for the created returns for each decade. Put the answers into the table. **Comment on your results.**
2. How do these results compare to the ones obtained in part (d)? Are they very different? Why?
3. Make a histogram of *S&P500* returns with 51 bins. Does it look normally distributed? Use the first 4 moments of the distribution to argue your case.
4. Find the *correlation* between *Gold, S&P500*, and *Your stock* for each decade. Repeat the same calculations for the returns. Put your answers into the table. Interpret your findings.
5. Is Gold a good hedge against the market portfolio?Why? Would you rather use the results you obtained for prices or for the returns to back up your answer? Explain.

Hint: A hedge against the S&P 500 is an asset that appreciates in value at times when the S&P 500 performs poorly.

1. Find the correlations between the returns on *S&P500* and *Gold* in 2020. Interpret the coefficient and provide plausible explanation.
2. How does *your stock* compare to the other assets? Use the results you obtained in (c) – (g) to answer this question.

ANSWER\_TABLE

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **80's(1985-1990)** | | **90's (1990-2000)** | | **00's (2000-2010)** | | **10's (2010-2019)** | |
|  | Mean | St.dev | Mean | St.dev | Mean | St.dev | Mean | St.dev |
| *Gold* |  |  |  |  |  |  |  |  |
| *SP500* |  |  |  |  |  |  |  |  |
| *DIS* |  |  |  |  |  |  |  |  |
|  | Mean | Sd | Mean | sd | Mean | sd | Mean | sd |
| *rGold* |  |  |  |  |  |  |  |  |
| *rSP500* |  |  |  |  |  |  |  |  |
| *rDIS* |  |  |  |  |  |  |  |  |
| *Corr(G,SP)* | level | Return | level | return | level | return | level | return |
|  |  |  |  |  |  |  |  |  |