AGEC622 - Agribusiness Analysis and Forecasting
04_Assignment

- Complete the exercises in the provided notebook "04_assignment.xlsx". a
- Work vertically down the sheet within your notebook. Separate the individual parts of the question(s) (a, b, c, ...) using dividing rows like the blue example dividers in the file.
- Format your assignment in a presentable manner. Failure to do so will result in a **20 point** deduction.
- Write down the names of all students you worked with on this assignment.
- Submit your completed .xlsx file via Canvas.

The overall objective of this question is to repeat the analysis from the previous exercise but using the multivariate normal joint probability distribution for simulating the four underlying stochastic variables.

a) **Build a model for the crop price.**

1) Regress $P_{corn} = \beta_0 + \beta_1 \times Year + e_t$
2) Test e_t for Normality. Use 90% confidence level.
3) If Normality test fails, convert corn prices into natural log, that is $= ln(P_{corn})$.
4) Regress $lnP_{corn} = \beta_0 + \beta_1 \times Year + e_t$
5) Test e_t for Normality. Interpret.
6) If the Normality test passes, proceed to part b. That is, do not yet generate the stochastic variables.

b) **Build a model for the crop yield.**

1) Regress $Yield_{corn} = \beta_0 + \beta_1 \times Year + e_t$
2) Test e_t for Normality. Use 90% confidence level. Interpret.
3) If the Normality test passes, proceed to part c. That is, do not yet generate the stochastic variables.

c) **Build a model for gasoline price.**

1) Test the series for stationarity.
2) Determine optimal number of lags and explain.
3) Use "Time Series" wizard to estimate AR model using appropriate number of differences and lags.
4) Test the the residuals for normality. Interpret.
5) If the Normality test passes, proceed to part d. That is, do not yet generate the stochastic variables.

d) **Build a model for variable cost (VC).**

1) Regress $VC = \beta_0 + \beta_1 \times P_{gasoline} + \beta_2 \times Year + e_t$
2) Test e_t for Normality. Use 90% confidence level.
3) If the Normality test fails, convert gasoline prices into natural log, that is $= ln(P_{gasoline})$.
4) Regress $VC = \beta_0 + \beta_1 \times lnP_{gasoline} + e_t$
5) Test e_t for Normality. Interpret.
6) If the Normality test passes, proceed to part e. That is, do not yet generate the stochastic variables.

e) **Jointly generate all stochastic variables.**

- Collect all of the recovered historical differences/residuals from parts a) through d) (all of the things we have been directly stochastically drawing) together in four columns. **Be sure to correctly align the observations**.
- Calculate a vector of means for the four series.
- Calculate the sample covariance matrix for the range of dates where there are observations for all four series.
- Calculate the sample correlation matrix for all four series.
- Generate these four series for 2025 through 2029 using the multivariate normal distribution.
- Validate the correlation matrix for the year 2025 for the four variables. Interpret the results.
- Use the simulated differences/residuals/errors/innovations to calculate stochastic values for the crop price, crop yield, gasoline price, and variable costs for 2025 through 2029.
- Refer to "USDA Agricultural Projections to 2034" 10-year baseline workbook to retrieve conditional mean forecasts for wheat prices for years 2025-2029.

f) **Simulate the stochastic variables for year 2025**. Simulate the four stochastic variables and run the correlation matrix from "Correlation Matrix" wizard. Interpret the result. Is this what you expected?

g) **Incorporate hail component into stochastic yields.** Assume annually there's a 5% likelihood that hail will damage crop yields by 80% to 100%. Use $= Bernoulli(0.05)$ to generate probability of hail each year and use $= Uniform(0.8, 1.0)$ to generate the damage each year. Adjust the stochastic yields accordingly for each year.

h) **Calculate financial variables for the enterprise.** Calculate NR and ending cash (beginning cash + NR) for each year for 2025 through 2029. Assume the fixed costs are \$130,000 and it increases 5% every year. The beginning cash in 2025 is \$50,000 in 2025.

i) **Simulate 2029 ending cash.** Determine the following values:

- Expected ending (2029) cash
- The probability ending (2029) cash is less than \$0
- The probability ending (2029) cash is less than \$100,000
- The probability ending (2029) cash is greater than \$150,000
- Generate the PDF and CDF graphs of ending (2029) cash. Place them on the main page and format accordingly.

j) **Interpret.**

- Do you have more confidence in these results or those from the 03_assignment? Provide detailed arguments.
- What problems, if any, do see with the revised model/analysis?