AGEC622 - Agribusiness Analysis and Forecasting
03_Assignment

- Complete the exercises in the provided notebook "03_assignment.xlsx".
- 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.
- Submit your completed .xlsx file via Canvas.

The overall objective of this question is to carefully specify the probability distributions that will be used for stochastic draws. You will use the CDFDEV function in Simetar to determine the best parametric (or nonparametric) distribution for each stochastic variable, and use hypothesis tests for the means and variances of the simulated values to determine if that best parametric distribution adequately represents the variable. For parametric distributions, we will test only $Beta$, $Uniform$ and $Normal$ distributions, along with an *Empirical* distribution, which is non-parametric.

Parameters for the 4 distributions:

- $Beta_x$ $(\alpha, \beta, Min, Max)$
- $Normal_x$ (μ, σ)
- $Uniform_x$ (Min, Max)
- $Empirical_x$ $(x_1, x_2, ..., x_n)$

General steps to follow for questions a-d:

Step 1. Detrend the variable (or take the first difference).

Step 2. Estimate the parameters using "Parameter Estimation" wizard.

Step 3. Simulate the residuals/differences using the distributions as instructed in subsections.

Step 4. Run CDFDEV function and pick the best distribution.

Step 5. After you pick the distribution, validate the simulated values using "Compare two Series". Interpret the validation results.

Step 6. If you decide to use *Normal* distribution, test the residuals/differences for normality as well.

a) **Build a model for the crop price.** You will generate stochastic forecasts for the crop price using a linear trend regression.

1) Use a simple linear trend to model wheat price and recover the residuals.
2) Use "Parameter Estimation" wizard and estimate the parameters by selecting the residuals.
3) Test the following 4 distributions: *Empirical*, *Beta*, *Normal* and *Uniform*. Simulate the residuals using these 4 distributions. Rename "SimData" to "SimData-a".
4) Use the *CDFDEV* function and pick the most appropriate probability distribution for drawing random residuals.
5) After you pick th distribution, use "Compare Two Series" tab to validate the simulated values.
6) Refer to "USDA Agricultural Projections to 2034" 10-year baseline workbook to retrieve conditional mean forecasts for years 2025-2029.
7) Generate stochastic wheat prices for 2025-2029.

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

1) Use a simple linear trend to model wheat yields and recover the residuals.
2) Use "Parameter Estimation" wizard and estimate the parameters by selecting the residuals.
3) Test the following 3 distributions: *Beta*, *Normal* and *Uniform*. Simulate the residuals using these 3 distributions. Rename the resulting "SimData" sheet to "SimData-b".
4) Use the *CDFDEV* function and pick the most appropriate probability distribution for drawing random residuals.
5) Calculate conditional wheat yields for 2025-2029 using the regression coefficients from part 1).
6) Generate stochastic wheat yields for 2025-2029.

c) **Set up stochastic simulation for the gasoline price.** You will generate stochastic forecasts using an AR time series model.

1) Determine an appropriate number of differences for the price data.
2) Determine the optimal number of lags for the AR model.
3) Run the AR model using the "Time Series" wizard.

4) Using the residuals from part 3), test the following 2 distributions: $Uniform$ and $Normal$. Rename "SimData" to "SimData-c".

5) Use the $CDFDEV$ function to pick between the two distributions.

6) Set up the stochastic forecasts for years 2025-2029 as you did in assignment 2.

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

1) Set up a multiple linear regression model. Assume that VC is a function of the gasoline price and trend. Recover the residuals.

2) Using the residuals from part 1, estimate the parameters for $Empirical$, $Beta$, $Normal$ and $Uniform$ distributions.

3) Generate stochastic errors using aforementioned distributions and simulate. Rename the resulting "SimData" sheet to"SimData-d".

4) Use the $CDFDEV$ function to pick the best distribution.

5) Calculate the stochastic VC for years 2025-2029. Use the regression parameters and stochastic gasoline prices from part c) to generate stochastic VCs.

e) **Calculate financial variables for the enterprise.** Assume that net returns (NR) are

$$NR \equiv Acres \times P_{crop} \times Yield - Acres \times VC - FC$$

Assume the following:

- The farm plants 1,000 acres in all years.
- Beginning cash for 2025 is $50,000.
- Total fixed costs (FC) are $130,000 for 2025, and this increases by 5% per year.

f) **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. Format the x-axis of the graphs with reasonable bounds. Place your graphs on the "main" page.

g) **What problems, if any, do see with the model/analysis?**