AGEC622 - Agribusiness Analysis and Forecasting
10_Exercises (in class)

Question 1. The overall objective of this question is to repeat the analysis from the 07, 08, and 09 exercises, but using the mixed marginal distributions with joint dependence for simulating the four underlying stochastic variables. We will be using 4 marginal distributions: *Beta*, *Uniform*, *Normal* and *Empirical*.

a) **Build a model for the crop price.** Repeat step a) from the 07_exercises, but do not yet generate the stochastic differences or the forecasts. Assume that these differences are drawn from a **normal** distribution.

b) **Build a model for the crop yield.** Repeat step b) from the 07_exercises, but do not yet generate the stochastic residuals/errors or the forecasts. Below, you will assume that these residuals are drawn from a **beta** distribution.

c) **Set up stochastic simulation for the gasoline price.** Repeat step c) from the 07_exercises, but do not yet generate the stochastic log differences or the forecasts. Below, you will assume that these residuals are drawn from a **uniform** distribution.

d) **Build a model for variable cost (VC).** Repeat step d) from the 07_exercises, but do not yet generate the stochastic residuals/errors/innovations or the forecasts. Below, you will assume that these residuals are drawn from an **empirical** distribution.

e) **Preparation for mixed marginals simulation.**

- Generate u variables corresponding to all of the recovered historical values from parts a) through d) together in four columns, using the appropriate $F_i(y)$ for each. **Be sure these are aligned correctly, with all observations on a row corresponding to the same observation date.** If you get a u value ≥ 1.00, replace it with 0.999. If you get a u value ≤ 0.00, replace it with 0.001. You should use the following approaches for four series:
    - For the crop price differences from part a), use =NORM.DIST, the relevant parameter estimates from part a), and specify cumulative as TRUE (that is, tell Excel we want a CDF rather than a PDF).
    - For the crop yield residuals from part b), use =BETA.INV and specify cumulative as TRUE.

- For the gasoline price log differences from part c), use =UNIFORMDIST, the relevant parameter estimates from part c), and specify cumulative as TRUE.
  - For the VC residuals, refer to the last slide in the lecture material.
- Generate four z variables corresponding to the four u variables.
- Estimate a sample correlation matrix for the z variables.

f) **Mixed marginals simulation calculations**

- Jointly generate all stochastic variables.
- Use the u draws, along with each series' respective $F_i^{-1}(u)$ to calculate stochastic values for each series.
- Use the stochastic errors to calculate stochastic forecasts for the crop price, crop yield, gasoline price, and variable costs for 2022 through 2026.

g) **Calculate financial variables for the enterprise.** Calculate NR and ending cash (beginning cash $+ NR$) for each year for 2022 through 2026, following the approach and parameters for this purpose from the 07_exercises.

h) **Simulate 2026 ending cash.** Determine the following values:

- Expected ending (2026) cash
- The probability ending (2026) cash is less than $0
- The probability ending (2026) cash is less than $100,000