Problem Set #1
BUSI 525

Skill and Luck in Performance Evaluation

In practice, we do not observe which funds are skilled or unskilled. We have to estimate this using data on realized returns (or holdings). Let's simulate some data to understand this problem.

For each part below, simulate a panel of $N = 1000$ funds with a time-series of $T = 120$ months each. Assume a market model data-generating process with normally distributed excess market returns and residual where the mean market excess return's mean is 5% per year and its volatility is 20% per year. Assume residual volatility of 30% per year and that all funds have a beta of 1. Monthly fund excess returns, r^e_{it}, are generated by:

$$r^e_{it} = \alpha_i + \beta_i r^e_{mkt,t} + \varepsilon_{it} \,,$$

where $\mathsf{E}[r^e_{mkt,t}] = 5\%/12$, $\text{sd}(r^e_{mkt,t}) = 0.2/\sqrt{12}$, and $\text{sd}(\varepsilon_{it}) = 0.3/\sqrt{12}$.
We will vary the distribution of skill (α) in the cross-section of funds in the parts below.

Part 1—No Skilled Funds:
Run the simulation assuming each fund is truly unskilled, so $\alpha_i = 0$ for all i.

1. For each fund, estimate its alpha and t-statistic. How many funds are skilled at the 5% significance level based on t-statistics?

2. Plot the distributions of t-statistics and p-values for alpha.

3. What does the distribution of p-values look like?

Part 2—Some Skilled Funds:
Now let's add some skill to the true underlying distribution. Suppose that a fraction of funds λ are truly skilled with alpha of 2.5% per year. What do the simulations and estimated statistics look like now? Consider λ values of 0.1, 0.25, 0.5, and 0.75.

1. For each λ value, make a plot of the cross-sectional distribution of estimated α, their t-stats, and the p-values. How does the p-value distribution change with the fraction of truly skilled funds?

2. How many of the truly skilled funds have insignificant alpha estimates? And how many of the truly unskilled funds are identified as skilled based on significantly positive alpha estimates? For each λ value, report the percentage of funds in each of the following classifications:

		Estimated Skill	
		Y	**N**
True Skill	**Y**	True Positive	False Negative
	N	False Positive	True Negative

NOTE: You are expected to upload your code and output to your GitHub site. Please also upload the PDF response document to Canvas, including a link to the GitHub code repository.