MScFE 610 FINANCIAL ECONOMETRICS

Group Work Project # 1

See grading rubric here.

Problem 1

Assume that the real regression model for y is the following:

$$Y(i)= \alpha + \beta x(i)+ \gamma w(i) + \delta z(i) + \varepsilon(i) \qquad (1)$$

However, the analyst erroneously estimates the model

$$Y(i) = \alpha + \beta x(i)+ \gamma w(i) + \mu(i) \qquad (2)$$

1a) If the error terms ε(i) satisfy the standard assumptions, does it mean that the error terms μ(i) do as well? Explain why or why not. **Just yes, or no, without discussion will earn no points!**

1b) What are the consequences for the estimates of the parameter of the model α, β, and δ obtained from model (2) vs. the ones that would be obtained from model (1)

1c) In what particular case would the estimates of the parameter of the model α, β, and δ obtained from model (2 the same as those obtained from model (1). **Hint:** what relationship is needed for the variable z with the variables, x, and w.

1d) Using simulations, create a known regression model containing two predictors. In this case the parameters of the model are known. Now omit one of the predictors and estimate the model. Compare the estimates of the coefficient of the non omitted predictor in both circumstances. What do you notice? If you increase the

sample size of the simulation, does the result change? HiNT: You create a model like

$$Y(i) = a + bX(i) + cZ(i) + e(i)$$

where a, b, c are known. Try simulating X and Z so that they are not necessarily independent and then estimate the model with 2 and only 1 predictor and pay attention to the estimates for b without omitting Z and omitting Z. e should be independent of X and Z, however!!

Problem 2

2a) Address the sensitivity to outliers for regression models in general. About half a page to a page in length, no need for more!

2b) Then, use a simulated instance to discuss/illustrate how the presence of outliers can change the estimated parameters for a regression model. Make a special effort to describe clearly how your simulation project was put together.

Problem 3

3a) Use one dataset below depending on your Group number:

- Odd Group number: **FE-GWP1_model_selection_1.csv**
- Even Group number: **FE-GWP1_model_selection_2.csv**

With the assigned dataset, perform model selection (i.e. find the best regression model for y in terms of x1, x2, x3, x4, and x5, using a few approaches (at least 2).

Valid approaches consist of (forward or backward selection, using adjusted R-squared, the AIC criterion, the BIC criterion or any other criterion you consider relevant) **It is important that you explain your work**. **No credit will be given if your model selection appears to be missing any justification and/or is done by a simple trial and error procedure.**

Problem 4

The elasticity of y with respect to x, defined as $(dy/y)/(dx/x)$ is very important in Economics and even in some financial applications.

4a) The following regression models were estimated. What is the elasticity of y in terms of X?

(a) $y = 2 + 0.8x$

(b) $\ln(y) = 0.1 + 0.4x$

(c) $\ln(y) = 0.1 + 0.25\ln(x)$

(d) $y = 0.15 + 1.2\ln(x)$

4b) What is the elasticity of y with respect to x in this case? Hint.. You must identify the correct regression to use for the purpose among the 4 given in the problem.

Problem 5

As a group, discuss and elaborate the following, and answer in the PDF report:

5a) Discuss the issue of stationarity for time series models. Describe how to test the presence of a unit root and explain what to do if one is found.

5b) Use real economic data for equities and illustrate if the time series you chose has a unit root.

5c) Why do you think in Economics and Finance we are concerned about a unit root and not, say a root of 1.5? Hint. Use simulations to understand what the time series would look like in the two cases.

Problem 6

Suppose that you are considering a simple linear regression model:

$$Y(t) = \alpha + \beta X(t) + \varepsilon(t) \quad t=1, 2, .., 20$$

And you suspect that the model may undergo a structural break of the β parameter at t=10. In other words you think that the model should more properly be:

$Y(t) = \alpha + \beta_1 X(t) + \varepsilon(t) \quad t=1, 2, \ldots, 10$

and

$Y(t) = \alpha + \beta_2 X(t) + \varepsilon(t) \quad t=11, 12, \ldots, 20.$

6a) How would you test this possibility using a single regression and a suitable dummy variable (a dummy variable is a variable that only takes the values 0 and 1). Hint. Do not work too hard, you just need a dummy variable properly chosen, and need to create an additional variable that involves X and the dummy variable …..

Groups

Groups of 3 students need to answer the questions for all 6 Problems.
Groups of 2 students are required to answer the questions for Problems 1, 3, 5, and 6.
Groups of 1 student need to address the questions for Problems 1, 3, and 5.

Submission Requirements and Format

1) ****1 PDF document with the answer to all questions.** This PDF should be no more than 3-4 pages in length and **must include all the comments, plots, tables, and the required results.** Do not send the readers back and forth to the Notebook.

   Be sure to include the specific question (e.g. 3b) before you put your answer. That means your submission will include every question number before the respective answer.

   The code used should only appear in the notebook, see below.

   a) Use the available Report Template and fill out the required information in the first page.

2) A **zipped folder** including:
   a) An executable Jupyter notebook* that addresses all the challenges
   b) A duplicate version of the Jupyter notebook code and output in PDF or HTML format.

i) In order to include the output of the code, you must RUN the code before downloading the PDF.

One team member submits the above on behalf of the entire group.

If you miss the proper submission, you will be penalized 10 points. At this point in your career as students at WQU you should know the drill. No excuses. Even if you are allowed to resubmit, the 10 point penalization will not be removed. Therefore PAY ATTENTION!

Direct copy/paste from AI tools is NOT ALLOWED. Heavy penalizations would be assessed if use of AI is detected. The purpose of the GWP is not to assess how well ChatGPT or other AI tools can answer the questions, but how the students would. **Your assignment will be checked against AI to determine if it was used.**

READ the **Academic Policy on the Use of AI**: **in-text citations and references are mandatory**, use **this link** to learn how to add them.

Make sure that all paper has a uniform format. This is a group task.. If each student uses different formats, it means that it was not really done as a group. Penalizations will be assessed if there are different fonts, sizes for different questions as this is evidence of the lack of group collaboration.

Rubric

Your instructor will evaluate your group submission for GWP1 using the following rubric:

Quantitative Analysis (Open-Ended Questions) 60 Points	Technical and Non-Technical Reports 40 Points	Writing and Formatting 20 Points
The group is able to apply results, formulas, and their knowledge of theory to real-life finance scenarios by doing the following: ● Providing all the necessary information to support their arguments. ● Presenting arguments that reflect group discussion and research. ● Using authoritative references to support a position and provide updated information. ● Concluding with practical takeaways for more insightful financial decision-making.	Technical Reports contain 3 parts: 1) **code** for each question (be sure to explicitly state the question number), 2) the corresponding output of that **code**, and 3) **interpretations** and/or **recommended courses of action** that reasonably follow from those results. **Note**: Technical reports will include the technicalities of models, such as names, methods of estimation, parameter values, etc., and exclude generalities about the work done. It should NOT include names of Python code that were used.	A submission that looks professional should: ● Include the axes, labels, and scales in graphs. ● Be free of significant grammatical errors or typos. ● Be an organized, well-structured, and easy-to-read document. ● Include proper citations and a bibliography in MLA format.
	Non-Technical Reports contain 3 parts: 1) clear explanation of results; 2) the recommended course of action that follows; and 3) the identification of factors that impact each portfolio. **Note**: AVOID all references to model names, algorithms, and unnecessary details. Instead, focus on the investment decision.	

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